THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION.

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TO POPULARISE ELECTRICITY.

WHY was it that the names of William Preece, Robert Ball, and certain other men of science became household words? We venture the opinion that in their ability to step down from a scientific pedestal and discuss in the terms and phraseology of the man in the street the fascinations of electricity and astronomy is to be found the explanation. Notwithstanding all our exhibitions, technical schools, popular lectures, scientific magazines and books, the fact remains that our many millions to-day are in the mass almost wholly uninformed with regard to electrical matters. Let any of our readers begin to talk at all knowingly on electricity, and what it has done, is doing, or is going to do, to any fellow traveller in the train or tramcar, or to an acquaintance at luncheon in a city restaurant, and he will find his companion to be ignorant yet eager for information.

We are convinced from careful observation that, speaking generally, the people are quite ready to listen to the man who is able to give them information on what is essentially a subject of present-day interest, provided he can do it attractively. Technical precision is a point of only secondary importance in such a case so long as the definite impression that the untutored mind can receive is made.

Commercial considerations naturally carry weight with the man of business, and his interest will be excited along that line of thought when we want to secure him as an electrical consumer; but we are inclined to question whether the "domestic" consumer, as we describe every householder and his wife in their private capacity, will be as easily won by our approaching the position directly with the commercial argument. There are many other possibilities in electricity and electrical service that might be found more attractive means for stimulating interest.

Say all that we may about publicity literature and the need for more of it of the right kind prepared expressly to meet the conditions of a locality, we cannot shut our eyes to the desire of the public to see actual articles at work. The pamphlet or the newspaper advertisement may tell them sufficient to promote that desire, but observations at exhibitions—take the popularity of the recent motor-car show at Olympia as a case in point—prove that the people will come where they can see, and observations at lectures prove their willingness to go where they can hear.

Everybody has been talking motor-cars during the last year or two; as the price of cars has fallen interest has risen, and purchasers and Olympia visitors have increased in number. What we need is for everybody to be talking electricity; the price of energy is falling, the cost of apparatus is down, and if only we can get the interest sufficiently aroused, the commercial result that we all desire will follow.

It seems that what we want at the present moment is more widespread lecturing of the popular order. Powder and shot are undoubtedly very useful in their way, but let

them be adopted in co-operation with the popular appeal that ocular demonstration can make. If we can secure the public interest and leave the hearer without any following suspicion that he has been subjected to a leg-pulling process, we will allow gas-signs to continue to give forth the false claim that "Gas is Cheaper than Electricity for All Purposes," without the least fear that such a statement can do our rivals any good. Lecturers who have travelled the country giving demonstrations of electric heating and cooking have done splendid service for the particular makes of apparatus in whose interest they have lectured, and have simultaneously assisted general electrical progress by educating the audiences that have gathered to hear them. All responsible for these demonstrations are to be congratulated upon their enterprise. Central-station men have not been slow to take advantage of the opportunity thus presented, and nobody will begrudge those who have spent the money, their reward.

But there seems to be room for far more both of this and other kinds of local lecturing and demonstrating, and the question will probably be asked as to who is to arrange it. We believe that electricity supply departments should take the initiative, and that they should operate in conjunction with the various firms who are making apparatus of kinds that will appeal to the average consumer.

Our American contemporary, the *Electrical Review and Western Electrician*, has lately been writing editorially upon the necessity for and benefits following upon central-station lecture service. An instance is quoted where an experienced lecturer appeared on the popular platform on an average three times a week from January to June, and it was found that in every instance new business resulted, the inquiries and subsequent application for service being directly traceable to the interest stimulated by the platform orator. Contracts were signed at the office as soon as it was realised that service could be had at rates far below the cost of luxuries. Here we find the commercial argument clinching the business after the interest has been sufficiently aroused to induce the visitor to attend and be informed. In one small American town the owner of a large residence applied during the evening for service involving over 200 lamps "as a direct result of the speaker's talk and illustrations."

We have no doubt that some of our readers could relate valuable experiences of a like kind as a result of conversations with exhibition visitors and after local lectures. Such experiences would be very welcome, and, we believe, would encourage in all parts of the country greater activity of the kind we commend above.

The L.C.C. Tramway Termini.

We wonder if anyone in authority in connection with the L.C.C. tramway system ever tries to board a tramcar at, let us say, Southwark Bridge or Westminster Bridge, to mention only two places among others which might be enumerated, between the hours of 5.30 and 7 p.m. Some attempt has been made to control the traffic at Southwark Bridge by erecting chains along the kerb, and indicating by signs where passengers should wait for various cars. Before these were erected it was the custom for passengers to wait in a long queue extending upward from Southwark Street to the terminus, and as soon as a car had crossed Southwark Street they would board the moving car as quickly as possible, until the rear platform and steps were packed and no others could find a foothold. The unsuccessful ones would then race the car, as many as possible hanging on to the handrail, or standing on the buffer in the hope of scrambling on before the car came to rest, by which time a compact mass of men and women, youths and girls would be struggling and jostling each other to try to get a position near the step. It was presumably to improve matters that the chain barriers were erected. The cars for certain destinations now have their appointed stopping places; the passengers line up behind these until a car arrives, and then they proceed two by two to enter. At least that is what they are supposed to do, but in practice they do nothing of the kind; they stand behind the chain until the car is coming down from the terminus, when they advance in a solid body to meet it, the strongest or roughest (and there are some very rough ones in the crowd) gaining the platform first, whilst the rest form a tightly-packed mass behind. With some pushing from the back, and others from each side of the step whilst the car is still in motion, it speaks well for the physique of the race—particularly the female portion of it—that serious accidents do not nightly occur.

Along the Embankment between Charing Cross and Westminster Bridge, and, perhaps, in a somewhat milder form near Waterloo Bridge, much the same kind of thing takes place, but here we have more of the running-jump order of things, those who manage to secure a foothold whilst the car travels along acting the part of a human scythe to those waiting along the kerb.

We have seen non-combative passengers miss car after car by being rudely pushed aside by the more self-assertive and unscrupulous members of the waiting crowd, who for the time being behave like the worst type of hooligans. This kind of thing does not occur at the doors of a theatre, where a queue lines up and the people enter in the order of their coming.

We are apt to speak derisively of the disciplinary rules and regulations in vogue in Germany, but we think that neither in Berlin nor in Paris would such a disgraceful state of things be tolerated. In Paris it was once, and may still be, the custom for waiting passengers to take a numbered ticket at the terminus or waiting room, and when the car or 'bus arrived to enter in the order of their numbers. It seems such a simple method, and is so effectual in practice that one wonders why the same system cannot be adopted here. Perhaps, as in the case of the railways, it needs the sacrifice of human life to stimulate the authorities to a sense of their responsibilities.

Rubber.

Although the best figures recently reached have not been entirely maintained, the tone of the rubber market has certainly of late undergone a substantial improvement with a moderate accession of confidence upon the part of consumers, due probably to a certain extent to the conviction that some sort of regulation of the distributive end of the trade would be undertaken as the result of the negotiations between plantation producers. Something like a settled attempt is being made to put matters on a rather better basis, without imposing restrictions of an unsound character, such as might eventually bring about fundamental weakness in the position. The idea seems to be that there should be a combination of the plantation interests, the arrangements in connection with which involve a fixed contribution per lb. of rubber produced, and which also tend to the introduction of something approaching uniformity in connection with the standardisation of plantation rubber. The greatest importance is attached to a system of standardisation, by many of the best friends of the commodity, and their efforts are being directed strongly and consistently towards the attaining of this desirable end, as a means of helping the market gradually to recover lost ground. In principle, most of the plantation companies are in favour of a combination, but there has hitherto been a certain amount of jealousy felt in some directions which has prevented the more general acceptance

of proposals put forward, having for their object the forming of an alliance of interests for what amounted to the mutual protection of the plantation industry. When this or that group starts too closely weighing up its own merits against those of its rivals, and is apprehensive that it is not getting all of the honey out of the pot, the formation of any effective and lasting plan of combination is hardly possible.

In any event, and whatever the outcome of the proposals, it is clear that sooner or later the all-important question of standardisation must be taken thoroughly and effectively in hand, for even yet plantation rubber does not meet with that acceptance in all directions which its many merits entitle it to receive. This matter was dealt with very concisely a few days ago at the meeting of the Tebrau Rubber Co., when Mr. P. M. Mathew pointed out that plantation Para rubber stands in a class by itself and requires different treatment from any class of wild rubber. The difference between plantation and wild rubber was, he said, a subtle one, which up to now had been impossible of solution by any chemist. It was certain, however, that it was not a question merely of curing, because the greater part of the world's supply of rubber was uncured. It was, nevertheless, possible that the superiority of fine hard Para arose partly from the particular process of curing to which it was subjected, and he suggested that until the same result could be attained in the Middle East by the means available, consumers would not be able to dispense wholly with the Brazilian product. To-day the output of plantation rubber was uncured, for smoking or treating with antiseptic vapour during the process of drying was not curing, nor did it impart to the rubber the characteristics of fine hard Para. Certainly, on a few estates a limited quantity of smoked sheets was being turned out, which, for the time being, realised a premium over crepe, but much of the smoked sheets coming forward was in a more of less damaged condition, and was wholly unfit for first-class work. In time, of course, the problem of curing will be solved, but the really big question of the day is that of standardisation. There has been an experimental station established at Kuala Lumpur by the Rubber Growers' Association, at which the manufacture of vulcanised rubber can be carried on, and this might be of the greatest possible service to the industry. The output of the Federated Malay States continues to expand, the total advised for the first 10 months of the year being 42 million lb., compared with 28 million lb. last year, and 15 million lb. in 1911. The really wonderful thing is that the world seems to be absorbing everything turned out, which is conclusive proof of the rate at which consumption has grown.

Is the Modern Petrol Car Misnamed?

In view of the many electrical devices that are found on the modern petrol car, one is inclined to ask whether it is not somewhat misnamed. First of all, one of the most vital constituents of an automobile is the highly-developed magneto that generates the spark for igniting the explosive mixture in the cylinders of the engine. The magneto displaced the old method of ignition by primary or secondary battery in conjunction with an induction coil, but the battery of accumulators has again made its appearance on the car, this time in a larger form and in conjunction with a dynamo, a switchboard, and the necessary adjuncts of wiring and electric lamps of various shapes and sizes. To these is now being added an electric motor, either combined with the dynamo or in separate form, to replace the old starting-handle method of starting the petrol engine. Still another departure, in which electricity is to play a leading part, and which, although found in only one instance at the recent Motor-Car Exhibition at Olympia, is already a feature of several cars of American construction, is that of doing away with the usual hand-controlled change-speed lever, and replacing it by an electrical method—controlled by a series of push switches on or about the steering wheel—of bringing the desired pair of pinions in the gear box into mesh. Having all this in mind, and also the fact that modern cars are also mostly equipped with electrically-operated motor horns, electric communicators, cigar lighters, and some even with telephones so that the rear passengers may give instructions to the driver, it would almost seem that the modern automobile is as much an electric as a petrol car.

The point that we wish to lead up to is this: seeing that the up-to-date car is being equipped with, in addition to a petrol engine, a dynamo, a motor, and a battery of accumulators, cannot the latter, instead of being additions to a chassis, also be employed as substitutes for some part of the mechanism? What we have in mind is the petrol-electric car, which has hitherto been somewhat swamped by the purely petrol vehicle, but which even for 'bus work is proving quite successful. It seems to us that now that the use of dynamo, motor and battery on a petrol car has become an accepted fact, it should only need a slight development to reach the stage where the power generated by the petrol engine would be transmitted to the rear road wheels electrically, thus doing away with the usual and still somewhat complicated system of mechanical gearing that exists between the engine and the wheels, in particular, the change-speed gear box, and at the same time performing the additional functions of engine starting and car lighting.

Unemployment Insurance.

From statements that are being made in various directions, fears are apparently entertained of a coming decline in the great wave of prosperity which has recently affected the trade of the country. Monetary stringency in different markets abroad limits the power to pay for requirements, and orders, in consequence, are held in abeyance, with adverse effects upon industries in this and other manufacturing countries. Mexico and other disturbed regions are also unsettling factors. We have no desire to meet troubles before they come, nor do we think it necessarily follows that electrical trade falls off materially when there is depression in some other trades; nevertheless, it may be of some interest to consider the position of those who have been contributing to the Unemployment Insurance Fund. Amongst these there must be a very large number of persons who are directly or indirectly concerned with the electrical trades. According to a report published by the Board of Trade a few months ago (Cd. 6,955), there is a very considerable sum now in hand. The following figures, which relate to a period of six months' working of the Act, are taken from the report:—Some 2,500,000 unemployment books were issued during the year. Of the total number of workmen insured, less than one-fifth were previously voluntarily insured against unemployment. The general income of the unemployment fund (from masters and men) was about £1,800,000, or, including the State contribution, £2,400,000. Expenditure on benefits, refunds and administration, has been at the rate of £700,000—but this, of course, was in a year of exceptionally good employment. About 560,000 claims were made on the fund. Broadly speaking, it is stated that the financial position at the end of the first year compares favourably with the estimates made by the actuary for a year of good employment; while the adoption of compulsory insurance has strengthened the tendency of workmen's associations to make voluntary provision for such insurance. A large number of associations (275) with a total membership of 1,104,000 have been admitted as satisfying the conditions enabling them to claim the State contribution in aid of their unemployment benefit, and of these members more than half are outside the insured trades.

Inasmuch as the Act has only been in operation during a time of exceptional trade prosperity, it is too soon to judge of the ultimate economic and social effects of the scheme. Its working during a period of depression has yet to be experienced. At any rate, there is a prospect that the insured trades will enter upon their next period of depression with an accumulated reserve fund of some millions sterling laid up during the present period of prosperity, together with an organisation already in being capable of applying that reserve to meet the needs of each of the trades in every part of the United Kingdom.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 890.)

Apart from the new departure in the way of electric engine starters, the most outstanding feature of the 1914 models of the leading motor car manufacturers is the provision of an electric lighting equipment; although still mainly employed on large cars, and those used for town purposes, electricity is rapidly ousting acetylene as the medium of illumination, even on more popular-priced cars, the range of electric lighting sets now available not only being extensive, but including some that are well within the reach of even the most humble motorists. Indeed so rapidly is the number of different dynamos increasing that at the present rate, there will soon be as many machines as there are makes of motor cars. At the recent Exhibition, I counted no less than 32 systems—not including those in which the dual work of car lighting and engine starting is combined—and those displayed do not include all that are at present on the market.

While there are many what may be termed intermediate systems, the principal means of current, voltage and output regulation range themselves into two main classes—one in which the work is accomplished electrically, that is, either by counter winding, subsidiary poles or extra brushes, and the other in which any increased speed of the dynamo is checked or prevented by centrifugally-controlled slipping clutches or other mechanical means. Without entering into a consideration of the relative merits and drawbacks of slipping-clutch and electrical current regulation, the opinion may be expressed that the tendency would appear to be in the last-named direction. Probably the greatest drawback to the system is the heat that is generated, but in many of the modern dynamos this is a difficulty that has, by careful design, been largely overcome. In fact, generally speaking, the dynamos show many improvements in detail; not only are commutators being made larger and wider, with the view of increasing their useful life, but the brush gear has been made either larger or has been duplicated, and, at the same time, rendered more accessible. There is a tendency, too, to run the machines at a slightly slower speed. Another indication that electric lighting has become the recognised medium of car illumination is seen in the fact that whereas a few years ago, the dynamo had to be located as best it could on a car, many of the leading motor manufacturers have now so re-designed their engines or chassis that even when electric lighting is not made a part of the standard equipment, provision is made for the driving of a dynamo, so that a generator can be added at any time. Just as, however, there is variation in the different dynamos, so is there a wide divergence of opinion as to the most suitable location of the generators and in the methods of driving the same. There is, furthermore, no standardisation in the methods of driving, for these comprise almost every possible form—belt, pinions, chain, and friction, and, in some cases, a combination of two of these methods. One feature of the growing popularity of car electric lighting has been the revival it has brought about in the business of accumulator makers, who with the advent of the magneto as the medium of ignition, experienced a considerable falling off in demand for the 4-volt batteries, which formerly supplied the current for ignition. As regards the switchboards used in connection with these lighting installations, these have probably undergone more improvement than even the dynamos. Not only are they now made almost entirely of metal, but more attention has been paid to the wiring connections, and to the form of switch used. In most cases, too, an ammeter and voltmeter are neatly embodied in the board. A good deal of the success or otherwise of a car-lighting installation depends not merely on the dynamo, battery, switchboard and lamps, that have been briefly touched upon, but on the methods and care adopted in connection with the wiring. A good feature to which attention may be drawn is that junction boxes are being employed, to which all the wires that must be partially on the chassis and partly on the body of the car, are connected.

From the following brief description of the different lighting systems displayed at Olympia, it will be noted that, the same as with the engine starting question, there is a wide diversity of opinion on various questions associated with car lighting by electricity, among them being the must suitable voltage, and the question of single or double wiring, all of which tend to show that there is little chance of standardisation for some time to come. It is therefore necessary, as has already been pointed out in the *Review* for each maker to issue with his productions a comprehensive handbook, written in non-technical language, so that users will be able to easily make themselves cognisant of the care and attention that must be given to the particular system adopted.

The C.A.V.—Dealing first with the British machines, it may be mentioned that the C.A.V. dynamos of Messrs. C. A. Vandervell and Co. continue to occupy a leading position among the many car-lighting equipments now on the market. They are being made in about half a dozen different sizes, and with voltages of 6, 8, and 12, being designed to meet the varying requirements as to output and driving speed. The feature of all the machines is the self-contained method of securing a steady output. The dynamo is provided with four poles, two of which are unwound and two wound in the usual way. Certain coils of the armature are continually short-circuited, the effect being that the magnetic flux is so distorted that the unwound poles become magnetized, the current passing to the battery in the usual way. As soon as the E.M.F. reaches a certain value, the subsidiary coils begin to act in opposition to the main ones, and as this antagonistic action increases in exactly the same proportion as the strength of the main fields is increased, a perfect balance is maintained between the two, thus preventing the current output exceeding a pre-determined limit. The machine, which is designed to commence to deliver current at about 400 R.P.M., gives its full output at 1,150 revs. Instead of an electric cut-in and cut-out device, a free-wheel clutch on the armature spindle, prevents the battery from discharging itself through the dynamo at low speeds of the latter. An improved form of brush gear is now fitted to the machines, there being four separate, wide brushes, the design being such as to ensure almost indefinite wear.

The Dependence.—A newcomer is seen in the "Dependence" dynamo, introduced by Messrs. J. and R. Oldfield, Ltd. The machine is of circular shape, the brush gear and commutator being enclosed by readily-detachable covers. The field magnets are shunt wound; the former-wound armature coils terminate in a commutator built up of 48 segments of hard-drawn copper, insulated from each other by mica. Radial-type coppered carbon brushes serve to collect the current, they being held in firm contact with the commutator face by four springs of the "safety-pin" type. The control of the current output is effected by the special shape of the two pole pieces, which cause an opposing current to be generated in the field windings, of a strength dependent on the distortion of the magnetic field, which is again proportional to the armature speed. Above a certain point, which is coincident with the attainment of the maximum output from the dynamo at a speed of about 1,750 R.P.M., the magnetic flux decreases owing to this cause; and this, in conjunction with the reaction in the armature coils, restrains the current output to a pre-determined limit, viz., 10 amperes at 12 volts. The automatic minimum cut-out switch, which is enclosed in a cap at the commutator end of the spindle, is of the mechanical type, with only one moving part working on the centrifugal governor principle. A 60-amp.-hour 12-volt battery is used with the set, an 8-volt equipment being also made.

The Kohinoor.—This new machine is made by Messrs. J. T. Williams and Co.; two sizes are made—75-90 watts and 120-140 watts, both working at 12 volts. The principal features are the use of a mechanical governor combined with the driving pulley which automatically prevents the machine being driven above a definite pre-determined maximum speed. The controlling switch, which is of the rotary type, is so arranged that whenever the head lamps are switched on, the battery charging switches are automatically put on at the same time; only the side and tail lamps used alone can be switched on at any time without putting the charging switch

in circuit also. Consequently, it is claimed that at no time is it possible to put a heavy strain on the accumulators.

The L.F.—Still another new dynamo is that made on the Lyons-Fellows system by Messrs. Arthur Lyon and Co. The machines, which are made in four sizes—4 volts, 30 watts; 8 volts, 90 watts; and 12 volts, 100 and 200 watts, are of the shunt-wound type with special provision for maintaining a constant output beyond a certain pre-determined speed, ranging from 600 to 900 R.P.M. according to size of the machine, this being effected by weakening the field magnetism as the speed rises. The main feature of the new machine is claimed to be the automatic cut-in and cut-out device which is combined with the switchboard.

The Lucas.—The dynamo lighting system made by Messrs. Joseph Lucas, Ltd., Birmingham, has been on the market for the past few years; the machine, which is of the enclosed shunt-wound type, is made in three sizes, viz., 8 volts, 6 amps., and 12 volts, with outputs of 8 and 12 amps. In the newest design the automatic regulation of the current output is effected by electrical means comprised within the dynamo itself, a third brush being provided to bring about a reversal of current at excessive speeds. It is claimed that a perfectly constant output over a wide range of speed, from 1,450 R.P.M. upwards is obtained.

The Lithanode.—Although still wanting a four-volt dynamo, Lithanode, Limited, have introduced two new machines, giving respectively 8 and 12 volts, with outputs of 9 and 7-8 amps. respectively. The machines themselves are of the usual shunt-wound variety, the feature of the system being that the regulation is entirely effected in the external circuit. The cutting in and out of the dynamo with the battery, which takes place at about 750 R.P.M., is effected by a centrifugally-controlled switch, mounted on one end of the armature spindle. The current is collected by means of two carbon brushes pressing on a couple of gun-metal slip-rings at the rear of the circular disc on which the switch is mounted. The generator delivers its full output at a speed of about 1,350 R.P.M. and, at any speed above this, the current is maintained at a steady level by means of a length of metal wire, which forms a resistance having a high temperature co-efficient. Any surplus production of current is dissipated through the resistance in heat, and this fact is made use of to provide, where desired, an electric foot warmer for the comfort of car passengers.

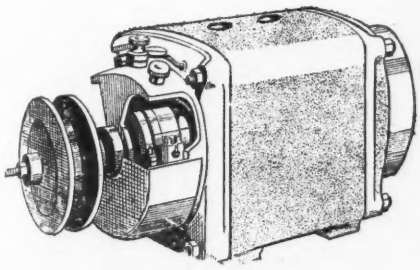

Fig. 12.—Lithanode Dynamo.

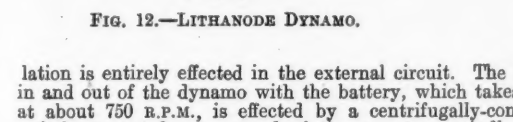

Fig. 13.—Lithanode Armature and Cut-out.

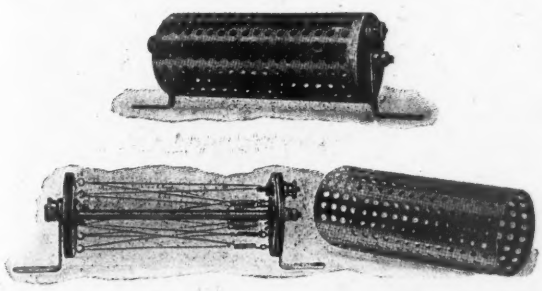

Fig. 14.—Lithanode Regulator, showing Cover Removed.

The Rotax-Leitner.—Among the popular types of car lighting dynamos is the Rotax-Leitner, controlled by the Rotax Motor Accessories Co. As the generator is made on the well-known Leitner system, it need only be mentioned that it is of the simple shunt-wound type with the addition of a third or subsidiary brush. The current from the latter passes through the fields and automatically regulates the dynamo output against fluctuations in speed. At the low speed the subsidiary current assists the excitation of the fields; at normal speed it is inoperative, while, at high speed it is in opposition to the main field windings. Several sizes of the machines are made, all working at 12 volts. The latest departure is a Leitner motor for engine-starting purposes, this being a simple series-wound machine, designed to be used to start the engine either through a friction roller or a pinion, both acting on the engine flywheel. A 20 to 1 reduction is provided for, a motor being also supplied having embodied with it a 4 to 1 reduction gear. A combination dynamo and starting motor is also being made; it is connected with the engine by a silent chain, the gear ratio, as a generator being 2 to 1, and, as a motor, through enclosed gearing, 18 to 1.

The Mira.—The Mira dynamo, made by the High Tension Co., is of the permanent-magnet type, and outwardly closely resembles an ignition magneto, there being only one moving part—the tunnel-wound laminated armature. The cutting in and out of circuit of the generator with the battery is controlled by an improved centrifugal device combined with the driving pulley. In the new arrangement, a curved arm which forms the balance weight, carries a platinum contact maker, which moves outward, closing the circuit, at a predetermined speed. The output of current at high engine speeds is maintained constant by armature reaction, this, however, only balancing the field magnetism and in no way tending to demagnetise the magnets.

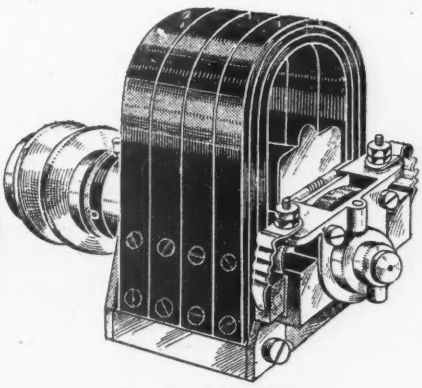

Fig. 15.—Mira Dynamo.

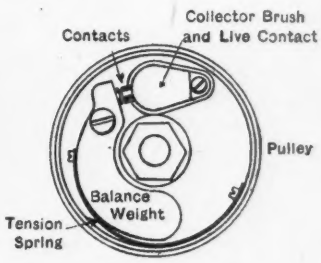

Fig. 16.—Centrifugal Cut-out, Mira Lighting Set.

The P and H.—Messrs. Powell and Hanmer, Ltd., who have for some time been supplying a lighting dynamo of the permanent magnet type, have now substituted for this a generator of the more commonly used design. The machine is entirely electrically controlled, the output at engine speeds beyond the pre-determined maximum, being maintained constant by the use of opposing pole pieces and the special winding of the armature. A feature of the machine is that the automatic cut-in and cut-out switch, which operates at from 500 to 600 R.P.M., is directly mounted on the dynamo above one of the main pole pieces, thus securing, it is claimed, a positive and powerful action of the switch. The generator is only made in one size, with an output of 90 watts at 12 volts.

The P. and R.—Messrs. Peto and Radford, Limited, are making three sizes of their 12-volt lighting dynamos of respectively 250, 150 and 90 watts capacity. The last named is a recent introduction; like the others it is of the plain shunt-wound type, the output of current being prevented from rising above a pre-determined maximum by means of an automatic slipping clutch carried in the driving pulley on the armature spindle. Working in conjunction with the dynamo is a magnetically controlled automatic cut-in switch.

The E.B.C.—The dynamo lately introduced by the Electric Battery Co. differs from most of the others that have been described in that the control and regulation is entirely of a mechanical nature. The output of the dynamo, a shunt-wound machine, is maintained constant, by making provision for it to be driven at a constant speed. To this end the driving pulley is connected with the armature spindle through a special form of four-armed centrifugal clutch which is in full engagement up to a speed of about 1,300 R.P.M., when by centrifugal action the two portions of the clutch become more or less disconnected. The dynamo begins to supply current to the battery at a speed of 250 R.P.M., the usual automatic cut-out to prevent the battery discharging through the dynamo at low speeds being replaced by a special free wheel clutch, as used on bicycles. The machine is made in three sizes, with outputs of respectively 80, 130, and 200 watts.

(*To be continued.*)

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Association of Mining Electrical Engineers.

I am told that to disagree with an editorial is almost as bad as trying to argue with a woman, and that in either case it is quite impossible to get the last word, but I think that some protest is called for by the leading article in your issue of November 21st.

Judging from the latter part of the article on "Electrical Accidents in Mines and their Prevention," it must have been written by someone with a grievance against the Association of Mining Electrical Engineers.

This, of course, is only an opinion, but there can be no two opinions that the writer does not know very much about the Association, or about its members.

I have looked very carefully into the composition of the (North of England branch as given in Volume No. 3 1911-1912) of the *Proceedings* and find that out of 159 members, 111 are employed by colliery companies, as agents, managers, engineers and electricians, 27 are engaged in sales work, eight are engaged in local works, six by the local supply company, five are consulting engineers, one is a boiler insurance company's inspector, and one a professor of electrical engineering.

Since the list given in Vol. 3 of the *Proceedings* was made up, about 40 additional members have joined, all without exception colliery electricians or officials.

Turning to the Committee of the branch for the current year, we find this to comprise one consulting engineer, one professor of electrical engineering, a colliery agent, two colliery managers, one supply company's engineer, seven colliery electricians, and only two who are "members for what they can get out of it," to quote the elegant phraseology of your leader writer.

Of course, the composition of other branches may differ from that of the branch to which I am referring, but as "one of those out for trading purposes," I have neither the time nor the knowledge of the other branches to enable me to give particulars of their composition.

As one who has looked to the ELECTRICAL REVIEW for light and leading during the last 16 years, I trust you will allow me this expression of my regret that you should have allowed your columns to be made the medium for an attack on an Association which, according to the Chief Inspector for Scotland, is doing a great deal towards increasing the safety of colliery working.

W. Baxter.

Newcastle-on-Tyne, *November 25th*, 1913.

[The leader criticised by our correspondent was written by the author of the article which led to the formation of the Association, who is familiar with almost every colliery in the country. Mr. Baxter's analysis indicates that 111 out of 159 members of the North of England branch are "agents, managers, engineers and electricians"; will he go further and tell us how many of these are "electricians"—the class by which, and for which, the Association was founded? One of the leading officials of another branch writes privately, saying that we are "quite right as to the colliery managers being on top in the Association, and any places which they have not captured are in the hands of the commercial members."—EDS. ELEC. REV.]

Electric Clocks.

Having had experience with both the Synchronome and the "Silent" system for electric time service, I was very much interested in the two letters *re* electric clocks in your recent issues.

It would be very interesting to many of us to know what the principles of electric time service are which Mr. G. B. Bowell has habitually transgressed. If Mr. Hope-Jones refers to the fact that in the "Silent" system the duration of the working impulse is longer than his economical mind approves of, I can only say that I consider the strong point of the Silent system is that every dial has the current on amply long enough to ensure the proper mechanical action of each dial. If the duration of the impulse is very short then any slight mechanical sluggishness in any dial results in that particular dial either missing fire altogether or getting along by the "skin of its teeth."

Batteries are cheap and skilled attention is dear.

If the "Judgment of Solomon" was pronounced on the "Short impulse babe," I can understand why Mr. G. B. Bowell would have willed its death. Nevertheless, I do not think that Mr. H. T. W. Bowell gives Mr. Hope-Jones the credit which is his in the technical development of electric clocks.

A. J. Bousfield, A.M.I.Mech.E.

Broadstairs, *November 25th*, 1913.

Joints in Submarine High-Pressure Cables.

In your issue of July 11th last appears a description of a submarine cable installation in the Baltic, in which it is stated that the installation in question affords the first instance of joints in high-tension cables being fitted at sea. Interpreting the expression "at sea" in its most general sense as meaning "not on shore," which is the only sense which appears applicable in the present instance, it appears to me that the installation in question is comparable with the installation of submarine cables across Sydney Harbour in the year 1902. In that particular installation, each of the two cables laid, consisting of three-core 37/16 paper-insulated, lead-covered, and double-armoured cables, contains several joints, made, as in the installation you describe, on a barge and lowered into water to a depth in some cases of 100 ft. After one unsatisfactory attempt, a suitable joint was evolved, and the cables laid with these joints remained in operation for several years until pulled up by a ship's anchor, as described in one of your issues at the time. I believe I am right in saying that the installation I have described was the first instance of submarine high-tension cable joints at such a depth, and I am glad to be able to say that the credit for these joints was due to the British Insulated and Helsby Cables, Ltd., at that time the British Insulated Wire Co., who were contractors for the cable, and my object in writing this letter is to direct attention to the fact, in order that credit may be given to the British firm, instead of priority to a German firm, as in your article.

O. W. Brain,
Electrical Engineer, New South Wales Government Railways and Tramways.

Sydney, *October 23rd*, 1913.

Diesel Engines.

Referring to my letter of November 17th and to your footnote, I said "articles," and was not particularly referring to your leader. The suggestion of panic was your own—"nerves" is a very different thing. Were my suggestions "derisive"? Anyhow, one is Mr. Taylor's, and appears in his report.

I am afraid I am rather inquisitive, but I do want to know why, if a reflux valve consisting of a box, a cage, and a ball is such an improvement and safeguard, it has not been put on the market and on every running Diesel engine long since? Might I very, very humbly venture to suggest that a "Sparklet" bulb be substituted for the ball.

I agree with you that Mr. Taylor's report is a very "model," and though we may differ with his conclusions, we must agree that it is well thought out, very practical, and worthy of careful consideration by anyone interested in Diesel engines.

Messrs. Elliott are the only firm who responded to my invitation to send particulars of a blast pressure recorder, and I fully expect that in time to come these instruments will be fixed with every Diesel engine.

C. J. Wood.

Sale Electricity Works.
December 1st, 1913.

A Question of Terms.

I am continually coming across the terms "fool-proof" and "mistake-proof" in reading descriptions of switchgear in your journal.

Previously the term was always "fool-proof," and one sees this term applied to the simplest as well as to the most complicated pieces of apparatus. Lately, in many instances, the term "fool-proof" has been replaced by "mistake-proof," evidently with the idea of conveying some fresh meaning.

It would be interesting to receive from your readers their definitions of these two terms.

P. W. Laverick.

London, S.E.

Canadian Electrical Trade.

In your last issue I replied briefly to a criticism by Mr. Leonard Andrews, and I then stated that I found myself in agreement with Mr. Andrews on the broad principle of Canadian electrical trade, but that I differed in specific details.

I venture to give below one or two of the details to which I referred.

In Mr. Andrews's fifth paragraph he says:—"My own opinion is that the interests of British investors who, according to Mr. Berry, have provided considerably more than half the funds for Canadian fire insurance, have been far better protected by rules and regulations drafted to cover the actual apparatus in general use than if they had been broadened to include apparatus manufactured in accordance with British practice, which is at present almost unknown in that country."

Surely, Sir, this method of reasoning is somewhat illogical. Surely it is putting the cart before the horse.

I submit that British investors would be better protected if the rules and regulations were drawn up in such a manner that they would admit the best electrical practice, irrespective of whether the goods are manufactured in Canada, the United States or Great Britain. In other words, the degree of safety to be obtained should be specified; not the method of carrying it out.

If we paraphrase Mr. Andrews's remarks with the context of his letter, he says: "My own opinion is that the interests of British investors *in Canada* have been far better protected by rules and regulations *drawn up by a committee of American specialists and represented by the National Board of Underwriters of Chicago*, and drafted to cover the actual *apparatus manufactured by American manufacturers*, and in general use in the United States and Canada, than if they had been broadened *with the assistance of British engineers* to include apparatus *manufactured by British electrical manufacturers* in accordance with British practice which is at present almost unknown in Canada."

Mr. Andrews says he agrees with me that the National Electric Code is built up "around the specialities of American manufacturers." Is it, then, surprising that apparatus manufactured in accordance with British practice is at present almost unknown in Canada? I think Mr. Andrews has unwittingly supplied the reason, but my untutored commercial mind finds it difficult to understand how the British investor has been "far better protected."

The next detail in which I differ from Mr. Andrews is in connection with the life hazard in Canada. The National Electric Code is not drawn up to safeguard life, except incidentally the loss of life by fire. A brief perusal of the Code makes this very obvious, but this point need not be laboured, for the Underwriters' engineers themselves admit that it was not their primary intention.

An insurance scheme for considering the life hazard, apart from the fire hazard, has, I am informed, been conceived by a prominent official of the Underwriters' Bureau, but it has never matured. It is obvious, however, that the life hazard cannot well be protected unless such regulations are enforced by the State under penalty.

In my original letter I referred to the inconsistency of a Code which insists upon an insulating lining for a metal cover to a 3-ampere switch, but at the same time allows in the same factory a switch of different construction one hundred times larger without any protective cover whatever. I do not wish to labour this detail either, for the Underwriters' engineers themselves admitted this obvious inconsistency.

Their defence, however, differs from the defence put forward by Mr. Andrews. They replied that their business was primarily to look after the fire hazard.

Mr. Andrews has wrongly assumed that it is only main switches which are allowed to be of the open type without any protected cover, but this is not so. Under the National Electric Code any branch switch from 5 amperes upwards, controlling a motor or any other piece of machinery, can be, and generally is (until the first or second accident occurs), left entirely exposed. No defence is offered for this inconsistency. It is an admitted anomaly.

It is because the Code has been built up "around certain well-known American specialities," instead of the specialities being built up around a suitable Code. It is the cart before the horse again. Mr. Andrews has also assumed that I take exception to an insulated cover to a 3-ampere switch, but I did not say so. I only drew attention to the inconsistency of a Code requiring it on a small switch, and not on the larger sizes. I accept the challenge, however. In point of fact, how many millions of 3-ampere switches are there in this country in use to-day, and how many have fibre covers? They are, as everybody knows, practically obsolete. In Canada the normal voltage is 110; in this country it is anything between 200 and 250, a much more difficult condition. In the early days when the voltage of supply was changed in this country from 100 to 200, a few engineers, out of a desire for extra precaution, specified a fibre lining for the tumbler switch, but it soon died a natural death; but what a calamity it would have been if our Fire Insurance companies, having heard that a few people had received a shock in a bathroom, made it compulsory that the other millions of switches of the same class should have fibre-insulated covers. Every self-respecting contractor would put up an all-porcelain covered switch in such a position in a bathroom, or ground a metal cover.

Some of our Fire Insurance companies possess engineers whose experience of wiring work is unsurpassed in any country, but I have never yet known any one of them who called for a fibre lining to the cover of a 3-ampere switch, nor have I ever heard of an outbreak of fire arising because this precaution was omitted. I should like to hear the opinions of, perhaps, two of our best-known fire insurance experts, Mr. Castle Russell and Mr. Lester Taylor.

In my letter to the *Canadian Electrical News* I stated a case showing another example of the danger of building a code around any speciality. I refer to the wholesale and injudicious use of the cartridge and plug fuse upon 110 volts alternating. What is the net result? An annual dead loss to the country of hundreds of thousands of dollars, or the admitted alternative, when the cartridge is abused—"not fuses, but fireworks."

This latter case is not criticism—it is a mere statement of fact, which up to the present I have not heard disputed. I trust, if there is a sound defence, it will be communicated to your journal. The mere plea of "interchangeability" cannot justify the situation. What I claim, as a prospective Canadian manufacturer with an increasing stake in the Dominion, is that we need to "get together" upon equal terms, without regard to nationality, to remove the admitted anomalies in the National Electric Code (as regards its application in the Dominion).

Is there any American, Canadian, or Britisher who thinks this unreasonable? If so, I trust he will accept the hospitality of your columns to give his reasons.

Herbert H. Berry.

London, *December 1st*, 1913.

Remarkable Motor Records.

I regret that time will not permit me to reply to the letter appearing in your issue of November 28th as fully as I should wish, but I hope to be able to do so next week.

Meanwhile, I would point out that if the machine described by your correspondent was run under the same conditions as the machines described in your article of October 10th, which have to run at 650 R.P.M. with less than one-third their full field, instead of 80 B.H.P., it would only be giving about 26 B.H.P.

H. Chitty.

London, N., *December 2nd*, 1913.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Standard" High-speed Alternator.

Mr. W. P. Durtnall, in collaboration with Mr. A. H. Binyon, has recently worked out a remarkable type of alternator, which offers notable advantages when driven by a steam turbine. While the latter should be run at a high speed in order to attain the highest efficiency in operation, as well as economy in construction, weight, and space occupied, the speed is often restricted by the frequency

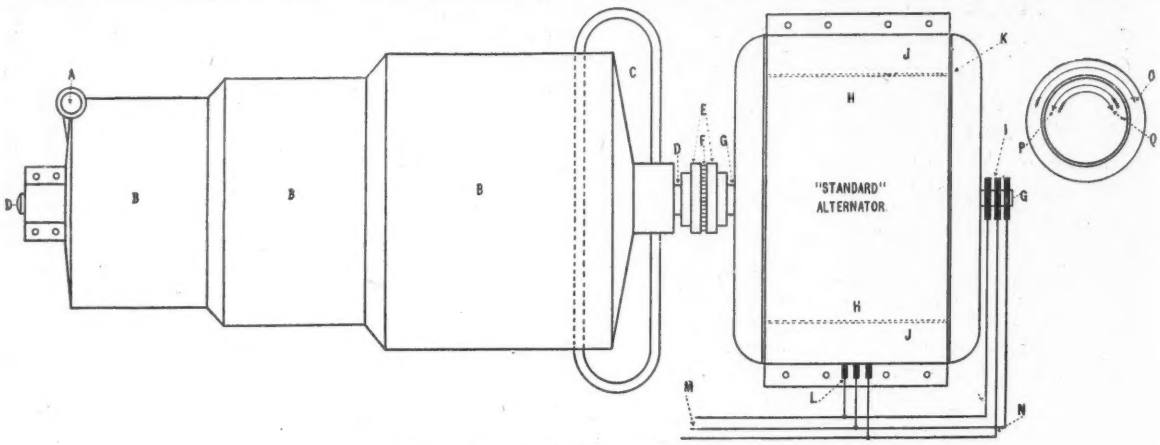

Fig. 1.—"Standard" Turbo-Alternator.

required of the generator; thus an ordinary 15-cycle alternator, even with two poles, cannot run faster than 900 R.P.M., and a 25-cycle two-pole alternator must run at 1,500 R.P.M. Obviously a great advantage can be gained if the rotational speed can be doubled without increasing the frequency, and Mr. Durtnall claims to have attained this end in his new generator, which embodies principles which have already been utilised in other machines of his invention.

The "Standard" turbo-alternator is illustrated diagrammatically in fig. 1. Steam is supplied to the turbine at A, expands through the stages B B, and is exhausted to the condenser at C; the turbine shaft D is driven at 3,000 R.P.M., and is provided with the universally flexible coupling E, which was described in our issue of October 3rd last, the flexible spring bolts being shown at F. The generator shaft G carries the rotor H, the windings of which are connected to the slip-rings I. The stator J has similar windings of the same number of poles, which are brought out to the terminals L, and the mains M are connected to both the stator and the rotor windings; it will be noticed that the leads of two of the phases are reversed at N.

This generator can be coupled in parallel with other alternators without preliminary synchronising. The process is as follows, starting from rest:—

First the slip-rings of the rotor are disconnected from the stator windings, and three-phase current from the bus-bars is supplied to the stator windings. The rotor slip-rings are now short-circuited through a couple of choke coils, and the machine starts as an induction motor, running up to a speed of approximately 1,500 R.P.M., and driving the turbine rotor. Next, the slip-rings are connected through the choke coils with the bus-bars, the connections being made so that the resulting magnetic flux in the iron of the rotor revolves in the direction shown in the small diagram at P, while the direction of rotation of the stator flux is that shown at O. The machine then runs up to a speed of 3,000 R.P.M. in the direction shown at Q, owing to the interaction of the magnetic fluxes in the stator and rotor. Both of these elements being supplied with alternating current, the rotor runs in exact synchronism with the bus-bar pressure, and when steam is admitted to the turbine, the choke coils being cut out and the connections made as shown in the drawing, the machine becomes a generator. Each element, both rotor and stator, contributes to the output, and there is no separate exciter, though, of course, like an asynchronous machine, the generator cannot operate unless the bus-bars are charged from another source. When, therefore, a "Standard" generator has to take the whole load, a small alternator of ordinary type or a double-current generator must be run in parallel with it, or mounted on the end of the shaft like an exciter.

The inventor claims not only that a 25-cycle turbo-generator can thus be run at 3,000 R.P.M., and, of course, a 50-cycle two-pole machine at 6,000 R.P.M., but also that the electrical design of the alternator is greatly improved by the division of the output between the rotor and stator, giving reduced weight of iron in each member, higher efficiency, a higher critical speed and less vibration. For large machines it will be possible to use four poles, while still running at 3,000 R.P.M., 50 cycles per second.

In the case of a 100-H.P. turbine running at 6,000 R.P.M., the steam consumption per B.H.P. is only 32 lb. per hour; the same turbine, when running at 3,000 R.P.M., gives only 50 B.H.P., and uses as much as 50 lb. of steam per B.H.P.-hour (non-condensing). The improvement shown is due to the higher speed rendered possible by the new design.

These machines are being introduced by the "Standard" Engineering Association, of 76, Gladsmuir Road, Whitehall Park, N. At first they will be of foreign make, but we understand that negotiations are in progress for their manufacture in this country.

It may be observed that the principle of independently rotating fields utilised in this machine can be applied also to the design of motors to run at two synchronous speeds, and to other purposes.

Governor Control Switch.

A new design of switch for mounting upon switchboard panels is shown in the accompanying illustration, fig. 2. It is designed to mount upon generator panels for the purpose of raising or lowering the speed of the generator by means of a motor controlling the governor.

The control switch shown is of a double-pole double-throw type, with a spring acting on the drum and returning it to a "mid-off" position when the handle is released by the hand of the operator.

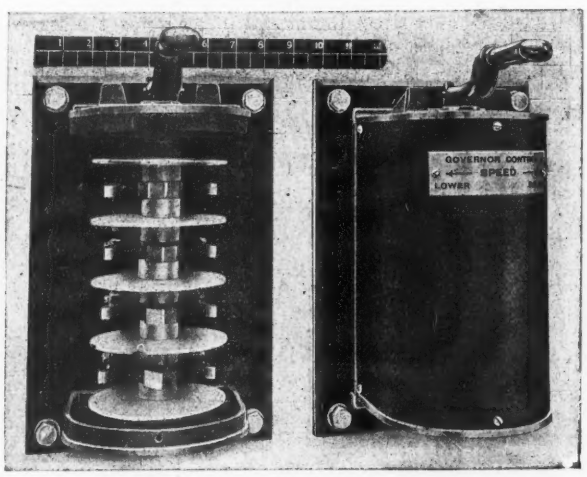

Fig. 2.—Governor Control Switch.

The contacts and terminals are neatly enclosed in a cover which can readily be removed for the purpose of inspection, cleaning, &c.

The device is manufactured by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne.

Liquid Starters.

A new design of liquid starter has recently been manufactured in large quantities by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., in connection with a number of complete installations for flour mills, cement works, and so forth, with which they have been entrusted. In this starter the cast-iron tanks, which contain the electrolyte, are mounted on a steel framework, the supporting bars being completely covered with moulded micanite—indeed, all tie bars that are required for mechanical strength are insulated throughout their whole length. The plates are lowered into the liquid by the rotation of a handwheel; the gear ratio is high, so that a rapid motion of the handwheel only slowly lowers the plates into the liquid, and it is impossible for the plates to descend by reason of their own weight. For completing the circuit between moving and stationary parts, each phase or pole is provided with heavy contact blocks, in addition to sparking rollers, which protect the contacts in the event of the starter plates being raised while the motor is running without its slip-rings short-circuited.

In view of the importance of keeping down the head room of liquid starters for colliery work, the larger sizes of G.E.C. starters

have been designed with two tanks in parallel per phase or pole, and a considerable reduction in the head room is thereby effected.

The whole of the internal arrangements are thoroughly protected, and enclosed by sheet steel covers. For direct-current work

Fig. 3.—Dust-Tight G.E.C. 400-h.p. Liquid Starter.

with shunt or compound-wound motors, non-inductive field discharge resistances can be accommodated in the bottom of the

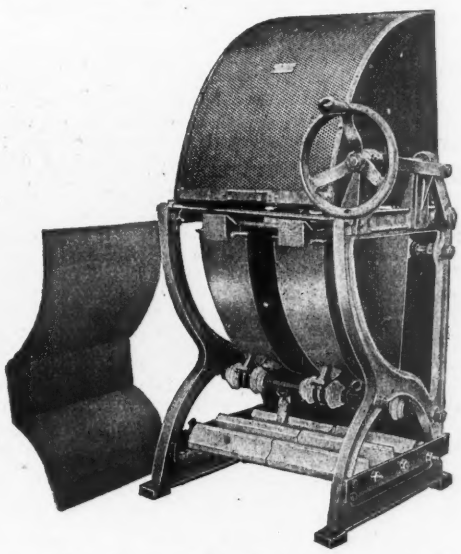

Fig. 4.—G.E.C. Liquid Starter for Continuous Current with Field Discharge Resistance.

starter. These are mounted on porcelain insulators in the fashion shown in fig. 4.

That these starters have filled the demand is evident from the fact that over 5,000 h.p. have been ordered for cement works alone.

British Radium Standard.—The National Physical Laboratory informs us that it is in possession of the British Radium Standard, which has been certified by the International Committee after comparison with the International Standard prepared by Madame Curie, and is ready to undertake the standardisation of radium and mesothorium preparations by comparison with the Standard. For the present, the Laboratory will confine itself to the testing of specimens which permit the use of methods depending on the measurement of the penetrating gamma rays. Tests on radioactive minerals, waters and the like, which are of feeble activity, cannot be undertaken. Particulars of the fees and conditions can be obtained from the Director of the Laboratory, Teddington.

LEGAL.

X.L. Electric Co., Ltd., *v.* Aron.

This action, which related to the protracted disputes between Mr. Aron, the inventor, and his co-director, Capt. Wiener, came on for hearing before Mr. Justice Neville, in the Chancery Division, on November 27th.

Mr. Moritz represented the plaintiffs, and Mr. Aron appeared in person.

Counsel said it was a case in which the company was seeking to restrain a director who had assigned his patents to the company from doing such acts as would prevent the patents from becoming effective. There were sufficient admissions in the affidavits to entitle the company to judgment, but Mr. Aron had put in a counterclaim. He, however, asked for an order for specific performance of the contract whereby the defendant should sell to the plaintiff company the entire benefit of the inventions set forth in the schedule. The statement of claim set out three patents as being in existence. The plaintiffs had in their possession certain letters that showed that the defendant had been requested to assign the patent and had refused to do so. One patent, No. 19,257, was still before the Comptroller, and in May last the defendant wrote to the patent agents, threatening that unless certain things were done he would block the proceedings. The matter was accordingly brought before the Court, and had been the subject of several interlocutory orders. An interim injunction had been granted restraining the defendant from preventing the protection being obtained, and requiring him to do all things necessary to carry out his agreement with the company, and it was now asked that that injunction should be made perpetual.

His Lordship said that the agreement was fairly plain; what was Mr. Aron's objection to carrying it out?

Mr. Aron said that under it the company were to supply the necessary money to complete the protection, and that they had not done.

Mr. Moritz said that the company had always been ready and willing to pay all the expenses under the contract.

His Lordship pointed out that whatever the defendant's rights might be under the counterclaim, there seemed to be no defence to the action.

Mr. Moritz said the same counterclaim had been put in in a King's Bench action which was pending, and had been struck out.

Mr. Aron said he was counterclaiming for arrears of salary, damages for breach of agreement, and wrongful dismissal, and money lent to the amount of £240. He pleaded the breach of the agreement in his defence, and he contended that that was a good answer to the claim for specific performance.

Mr. Moritz said that though a great deal of prejudice had been imported into the case, he was willing to make an offer which he thought would be fair and reasonable. The plaintiffs were clearly entitled to an injunction and to a mandatory order with the object of obtaining specific performance of this agreement, and if the defendant would submit to that they would not ask for costs. They had already paid upwards of £400 in respect of costs of interlocutory matters, and did not think any order for costs against Mr. Aron would be of any value. The company had carried on for a considerable time, but owing to these unfortunate differences it got into difficulties, and Capt. Weiner, who held the debentures, appointed a receiver. There was no claim on the defendant for the patents. Where the patent agents' claims had not been paid they had looked to Capt. Wiener for payment. The company were quite willing to hand over to Mr. Aron the 4,400 shares he claimed. They had the scrip in their possession.

Mr. Aron said that was not of much use now, as Capt. Weiner had secured the assets of the company for £6,000.

His Lordship pointed out that as the company had apparently now no assets, it would not benefit the defendant if he succeeded in his counterclaim and the costs of the action, which would most likely exceed the costs of the counterclaim, even if awarded to him. Mr. Aron must remember that this was an action by the company and not by Capt. Wiener, and whatever claim he might have could not be enforced against Capt. Wiener by counterclaim in this action. The company had a large claim against Mr. Aron for costs, and were willing to give him a clean slate up to that time.

After some further discussion, it was agreed that, on the company's undertaking to pay all the costs incidental to the carrying out of the agreement, and to make no further claim upon the defendant in respect to anything up to that time, there should be an order on the defendant to do all things necessary for carrying out the agreement. As certain documents required signature, it was agreed that the order should not be drawn up until Tuesday, December 2nd, and that the defendant should attend before the registrar on that day and sign them.

Dundee Tramway Accident.

Before Sheriff Neish last week an action by a farmer, who sued the Corporation for £200 in respect of damages alleged to have been sustained by him in a tramway accident, was heard. The farmer, whose van was struck by a car, said he did not think the car was under proper control, and that it was going far too hard. He had learned that the driver was a spare man. Mr. Peter Fisher, the tramway manager, in his evidence, said that under the circumstances the emergency brake was the proper one to use, and that the slipper brake would have been absolutely useless. The Sheriff made avizandum.

Speake *v.* J. Stringer & Son.

At Blackburn County Court, on Monday, before Judge Sturges, Thos. Speake, electrical engineer, claimed £3 5s. from John Stringer & Son, Railway Road, Blackburn, damages for breach of warranty on the sale of a gas engine. Mr. H. Haworth appeared for the plaintiff, and Mr. Riley for the defendants. Plaintiff stated that he purchased the engine, which was a secondhand one, from defendants for £9. The salesman guaranteed that it was as good as new in every way, and in good running order. The engine was fixed, and it was then found that the water jacket had a crack in it. The defence was that defendants did not give a warranty. It was stated on the invoice that the gas engine was purchased "as seen." A verdict was given for plaintiff for the amount claimed.

Baxter & Caunter, Ltd., *v* Levetus.

In the King's Bench Division Mr. Justice Coleridge and a jury were engaged during three days—November 24th, 25th and 26th—in hearing an action for damages and an injunction brought by Messrs. Baxter & Caunter, Ltd., against a Mr. Levetus.

According to the statement of Mr. Ralph Bankes, K.C., who appeared for the plaintiffs, the claim for damages was made on the ground that the defendant had injuriously interfered with their business, an allegation which the defendant denied. The plaintiffs, said Mr. Bankes, carried on a very considerable business in electrical goods of all kinds in the Tottenham Court Road. The extent of their business might be gauged by the fact that they received about 4,000 letters a week. The defendant was an exporter, and in the course of the case, said counsel, he hoped to be able to show that he (defendant) had entered into an ingenious scheme with one of the plaintiffs' employés to get their business away. The scale of prices for the home trade was a good deal more than that for the export trade. The firm sent out two lists, one of which was for the home trade, which was a very large one dealing with everything connected with electrical appliances. There was also a dead net price-list for the export trade. This list was sent amongst others to the defendant, who had another name under which he transacted certain business—(Rodwell & Co.). He sent out a circular letter to about 45 of the plaintiffs' customers, in which was enclosed a copy of plaintiffs' export price-list, and in which special goods were offered at such prices. Thus he endeavoured to sell plaintiffs' goods in this country at the export prices, and when Rodwell's obtained an order the defendant sent a similar order to the plaintiffs as an export order. Then having got the goods at export prices he sent them out from Rodwell & Co., thus cutting the plaintiffs' home trade.

A number of witnesses were called in relation to the manner in which the plaintiffs' trade had been affected by the defendant's conduct.

In the result the jury found for the plaintiffs, assessing the damages at £10.

His Lordship entered judgment for the plaintiffs for the amount of the verdict, with costs on the High Court scale, and gave liberty to apply as to the injunction, if necessary.

Workmen's Compensation Claim.

At Manchester County Court on Tuesday, before Judge Mellor, Charles Martin, aged 29, claimed compensation in respect of an accident, from Messrs. Mather & Platt, of Park Works, Newton Heath, by whom he had been employed as an electric crane driver.

Applicant told the judge he was driving a crane down the shop empty, and moved a lever which brought it round to the right, where it struck some machinery. He received a shock, he alleged, through the crane coming into contact with the machinery. After the accident he was attended by a doctor, and later was an inmate of the Booth Hall Infirmary.

The respondents, for whom Dr. Eastham appeared, contended that the applicant could not possibly have received an electric shock in the manner alleged, that the man suffered from general paralysis, and that his condition was in no way connected with any accident. It was stated that Martin could not have received an electric shock, as an examination of the electric wires after the accident showed that they were quite intact.

The Judge, having received the report of the medical referee's examination of the applicant, decided in favour of the respondents, stating that the doctor found that Martin's condition was entirely due to natural causes, and could not have been caused by any accident, let alone such has had been described.

Dr. Eastham said he would not ask for costs unless there was a Union concerned in the case.

The Judge: Have I power to grant costs against a Union? I have no evidence before me that there is a Union.

Mr. Thorpe: I will satisfy my friend at once that there is no Union.

Dr. Eastham: That being so, I don't apply for costs, but I should have done so if there had been a Union.

Hankow Light and Power Co., Ltd.

In the Chancery Division on November 26th Mr. Justice Joyce heard a motion by the plaintiff in the action referred to in our last issue, to restrain the defendant company from declaring a cumulative dividend on their ordinary shares in prejudice to the rights of the holders of deferred shares.

Mr. Stone on behalf of the plaintiff, said that Article 5 of the memorandum of association provided that ordinary shares should be entitled to a non-cumulative dividend, but Article 6 gave the company power to reduce and sub-divide capital, or to issue any shares original or increased "with any preferential rights, privileges or position as to capital dividend or voting." All the shares issued had been allotted between February 9th and March 1st, 1906, and the complaint was that on February 9th a meeting was called for the 16th to consider a resolution for giving the ordinary shares a cumulative dividend. It was, he submitted, an abuse of the powers of the company to call a meeting with reference to the rights of shareholders and then allot deferred shares to people who probably knew nothing about it, but whose rights would be affected. Although the resolution had been passed so long ago, the company had only recently come into a position to pay dividends, and therefore the question had not arisen until now.

Without calling on counsel for the company, his Lordship refused the motion on the ground that the plaintiff had not made out his case, but said he was by no means clear that at the trial the plaintiff might not be entitled to relief.

Tramcar Obstruction.

The driver of a motor-lorry has been fined £3 and costs for obstructing a tramcar of the East Ham Corporation, in Barking Road, on November 11th. The lorry remained on the metals running at a speed of 3 or 4 miles an hour, while a tramcar gong was sounding in its rear for eight minutes.

Electricity in Mines: Prosecutions.

At Doncaster West Riding Police Court, last week, George Williamson, electrician, of Mexborough, was fined 5s. and costs, for having committed a breach of the Mines Act by leaving his lamp-holders, which were terminals, on a live electric circuit, in the Denaby pit approach, in an unprotected state, rendering open sparking liable to take place.

At Airdrie Sheriff Court on Monday (December 1st), David Reed, colliery electrician, Armadale, and James Eadie, certificated manager of No. 11 Blairmuckhill Colliery, Harthill, were charged with having in the case of the electrician, failed to make a thorough examination of all the electrical apparatus in that mine, including the testing of earth connections and metallic coverings, and in the case of the manager with failing to have electric cables covered with insulating material, with the result that some of the cables specified in the complaint had been left bare and open to danger. Both respondents pleaded guilty, and it was explained that they did so to a technical breach only. The mine had had an installation of electrical plant for over 14 years, and during all that time its working had been absolutely satisfactory until quite recently it was recognised in practice that a qualified electrician was responsible apart altogether from the responsibility of the manager, and it was in consequence of a recent decision of Sheriff Shennan, at Hamilton, that that view was disturbed. In this case it was thought that there would be justification for distinguishing between the manager and the electrician, and that no penalty should be imposed on the manager and a nominal fine on the electrician. The Fiscal pointed out that the Inspector of Mines was strongly of opinion that electrical apparatus in all mines should be in such a condition that no accident to the workers could occur. The charges against the manager were of allowing cables in the roads to be bare and open, with the serious risk of workmen coming in contact with those charged cables. The electrician was bound by the rules to make daily inspection of all the electrical plant within the same mine, and at once report defects and get them put right. In this case there were a great many parts of the cable bare, and the consequences might have become serious if the cables had been charged.

Sheriff Lee said the fact that heavy penalties were imposed under the Act on ordinary workers contravening it, made it quite necessary, when the management was at fault, that there should be considerable penalties enforced. He thought he was justified in looking upon the charges here as being against the management of the colliery, and that the person primarily responsible was the engineer. If the manager put a qualified electrician in charge of his mine, it was difficult to see how he could do more, but he, personally, was not supposed to be an expert in electricity himself, and interference on his part might not only be an impertinence, but a danger. At the same time, the manager was technically wrong if he did not discharge the duty of supervision, so that ultimately he was responsible.

His Lordship fined the electrician £5, but imposed no penalty on the manager.

London Tramways Assessments.

In the Divisional Court, before Mr. Justice Bray and Mr. Justice Lush on Tuesday, Mr. E. Charles, K.C., appeared on behalf of the Islington Assessment Committee, to show cause against a rule for a mandamus granted in July last, ordering the committee to appoint a person to make a provisional valuation list with a view to inserting a portion of the London County Council tramways in the borough at a reduced assessment in consequence of a reduction in profits owing to motor-'bus competition. According to the report in the *Daily Telegraph*, Mr. Charles said that in order to

justify a reduction in the assessment it must be shown that the reduction was substantial, continuous, and permanent. The Assessment Committee, some time ago, appointed a valuer who had formed his own conclusions on the figures supplied by the London County Council themselves. He had come to the conclusion that there was no *prima facie* case for reduction at all. The quinquennial valuation was never intended to be disturbed by trade fluctuation.

MR. RYDE, for the County Council, maintained that for the purpose of ascertaining whether there had been a reduction in profits the figures for the year in question must be compared with those of the preceding year, and not with those of the year in which the quinquennial valuation had been made.

MR JUSTICE BRAY said it was necessary not to look merely at the reduction which had taken place during the year preceding April 5th, 1913; they must go back a little further. One could only have the impression that the 'bus traffic must have had a considerable effect upon the receipts of the tramways running along the same routes. He was of opinion that sufficient continuity of decrease of profits had been shown, and that this was not a mere fluctuation. It was also clear that the Assessment Committee had gone wrong on a matter of law.

MR. JUSTICE LUSH said that, in his opinion, a *prima facie* case had been made out. Therefore the mandamus ought to go.

The Court made the rule absolute for peremptory mandamus, with costs.

REVIEWS.

Switches and Switchgear. By PROF. R. EDLER. Translated by P. Laubach. London: Constable & Co., Ltd. Price 15s. net.

Up to the present there have been very few books dealing with switchgear printed in English, but apparently this dearth will rapidly be remedied. This translation of Prof. Edler's well-known and comprehensive work will decidedly help to fill the gap, although it naturally deals far more extensively with German than with English practice, and further, in several instances, the book does not correspond with modern ideas of design. For example, in the introductory chapter, special attention is directed to the statement that the hinge or pivot of a switch must not carry current—a false idea which has been exploded for a considerable time.

Chapter II deals with the design and proportioning of connecting leads, cable sockets, contact blocks and so forth, and the treatment is detailed and thorough. In large switchgear the dimensions are fixed by the permissible temperature rise of the current-carrying parts, and due attention is paid to this.

In Chapter III we have a discussion on the design of contact springs, brushes, carbon contacts and devices to eliminate sparking at the main contacts. A number of illustrations are introduced, and though to a somewhat small scale, they are so beautifully executed as to show the various types of construction quite clearly.

A good description of several types of switches and change-over switches is given in the succeeding chapter, together with some empirical rules for determining centres, &c. The essential principle of the quick-break switch is emphasised, *i.e.*, it is pointed out that it consists in making the speed of breaking a circuit independent of the speed at which the switch lever is moved, so that no matter how slowly the lever is moved, the path of the current is always opened at one and the same predetermined speed. The design of the necessary tension springs is entered into in detail.

Chapter V deals with the delicate subject of high-pressure switches. The difficulties associated with such apparatus are fully discussed, and the methods for successfully overcoming them are clearly described, although the reviewer would not care to see several of those illustrated on a high-pressure circuit. The numerous forms of horn-type lightning arrester, and the multiplicity of oil switches now on the market, receive detailed attention.

The design of fuses for all types of circuit is next dealt with, and a great quantity of information is given, being based, of course, practically entirely on German experiments, which appear to agree, however, as far as the reviewer has been able to check them, with the classical experiments on this subject by Prof. Schwartz.

Chapter VII is devoted to the discussion of automatic circuit-breakers, time-limit and reverse-current relays. The principles underlying the various contrivances are first explained, and then a large number of fairly well-known automatic switches are examined in detail. Several useful connection diagrams are included in this chapter.

By far the largest chapter in the book is the next, dealing with starting and regulating switches and controllers. The theory of the calculations for the starting resistances for direct-current motors is first expounded, and exemplified by its application to a 10-H.P. shunt-motor. Bragstad's graphical construction, as given in "Die Gleichstrom-maschine," is described at considerable length. The theory of starters for alternating-current motors is next dealt with in a similarly satisfactory manner. Regulating resistances for all types of generator and motor are then considered in great detail. A large amount of analysis is used, and this is quite in order from the point of view of accuracy. The mechanical design of the resistances, such as the pros and cons of circular coils, strip, &c., is then discussed, a large number of useful illustrations being given. Automatic and relay starters receive a due amount of consideration in the succeeding section, and finally the tramway type controller is discussed in relation to the large field of work for which it is peculiarly adapted.

The concluding chapter deals solely with battery switches and their appendages, and is quite satisfactory; a short index is added.

As a whole, the book is quite desirable, although practically all the references refer to German publications and researches, while the account of the apparatus made by one firm, and the frequency with which its name appears in the text and in footnotes, get rather monotonous after a time. English units and dimensions are used as a rule.

The book is well printed and bound.—H. G. S.

Graphs in a Cable-Ship Drum-Room. By E. RAYMOND-BARKER. London: H. Alabaster, Gatehouse & Co. Price 2s. 6d. net.

This work is a reprint of the articles which appeared in the ELECTRICAL REVIEW this year, treating of different ways in which the usual calculations relating to cable operations can be made—namely, the length of cable picked up or payed out in a given time, the rate at which it enters or leaves the ship and the percentage slack in paying out.

Dealing with the first-mentioned topic, the author gives a curve or ratio graph showing the variation in the drum constant for different sizes of cable on a drum of given dimensions. The increase of length per drum revolution for different sizes of cable is further considered as a percentage, and the length of cable in an actual case for a given number of revolutions is worked out by the aid of a curve or ratio line of percentage, as well as by the customary method. While such a way of arriving at the true length picked up might be regarded as an instructive alternative, we hardly think the author would recommend it in place of the single calculation usually made, namely, dividing the revolutions by the drum constant for that particular cable. For the percentage method involves three arithmetical calculations, as well as a curve observation, thus introducing greater liability to error, and requiring more time.

The same may be said of the example given on pages 21 and 22, in which four types of cable are successively payed out. By the usual method of computing the lengths, only one calculation (division) is required for each type of cable, but in the graph method described it is necessary to inspect a curve to obtain the percentage increase of length and then make three arithmetical calculations (division, percentage of mileage, and addition). Thus in this particular example there are 16 things to do by the graph method as against four by the ordinary calculation.

In Example 34 the uncorrected constant given does not agree with the lettering in fig. 3 referred to, which leads to confusion; probably d_3 should be substituted for d_1 in the text, and if so the correction should be made in three places on pages 20 and 21.

Certain marks appear on the curves or graph lines in figs. 3 and 4, indicating values stated to be taken from the tabular records of two cable expeditions. This rather conveys the impression that the data referred to have assisted

in the plotting of the ratio lines, especially as the points are marked thereon. It would perhaps be as well to explain that the only dimension necessary is the drum diameter or circumference. The graphs or ratio lines can be plotted for a given drum to cover any range of cable or rope circumferences without reference to, or confirmation by, any tables used in expeditions. They are hard and fast physical relationships, and the various points marked on the lines are for that reason bound to fall thereon. If two points only are calculated, one at each end of the scale, and a straight line is drawn connecting them, that line will be correct for all intermediate values.

The introduction of the drum constant reciprocal on pages 14 and 15 is a little unfortunate, as it is never required and means the extra complication of a figure to six or seven places of decimals. Division on the flat slide rule is more readily performed than multiplication, and where both operations are successively required practised hands always make the division first, for well-known reasons. In examples 36, 37 and 79, it would be more straightforward to use the drum constant instead of the reciprocal. It might have been explained that it is not practicable to measure cable circumference to the third place of decimals as in the list on page 14 by the method given on page 16, nor is it possible to read to the third place of decimals in the chart on page 15 even when the dimensions of ordinates are doubled.

In the reference to drum-revolutions per minute on page 21, it might have been explained that in accurate work it is impracticable to observe fractions of a revolution on a rotating drum or measuring wheel, and the revolutions over a period of several minutes must be taken and divided by the number of minutes. For instance, the drum speed of 45·7 revolutions per minute and the measuring wheel speed of 118·3 revolutions per minute given on page 32 would be taken this way. When time admits of only one minute or thereabouts for an observation a whole number of revolutions must be counted, say 40, and the time in seconds taken by a stop-watch. Then the correct revolutions per minute is obtained by dividing the revolutions by the time in seconds and multiplying by 60.

Dealing with cable slack calculations, the author describes the use of his "calculator board" applied to this purpose. Of the two arrangements shown on pages 28 and 32, the latter is probably the more useful, being limited to the cable drum and measuring wheel speeds in common practice. The board on page 28 might with advantage have been omitted altogether, as it deals with so wide a range of speeds that three sets of percentage lines are required, and liability to a mistake in using the proper set of lines would be an unreliable feature in actual work if such a board were employed. The board on page 32 should involve no liability to mistake in careful hands, but its use would not appear to save any time, as attention to accuracy is necessary in setting the cursor threads at the correct figures and fractions, and in making sure they are set truly square. The means provided for setting the threads described in paragraph 84 are not very satisfactory, and might be improved in obvious ways. The relation dealt with is between three quantities, any one of which may be determined from the other two, and such calculations can be made expeditiously enough on the slide rule.

The author appears to have seen the necessity of some simpler appliance if any aid to such calculations is required, and in the last few pages shows the lines on which he has developed the disk calculator. This is a more simple appliance, free from the disadvantages of the calculator board above referred to. Many such disk calculators are in use, and the difficulty the author has experienced with the transparent disk (Paragraph 100) may be overcome by fitting both disks in a metal ring, having a slot in which the transparent disk works, and by giving it a concentric corrugation.

The experienced engineer usually prefers to steer clear of all such aids if he finds their use tending to divert his attention from the direct object of his calculations. He may make up tables or other aids himself, and use them; but being his own he employs them with reliance and without having his mind led into channels other than the object in view. It must, however, be borne in mind that this book is addressed to juniors, and to such the work should be of service in pointing out different ways in which calculations on board ship may be made. In following out the ideas in the book the reader will note with satisfaction that the figures are taken from actual work at sea, and that the author is one whose wide experience imparts especial value to any particular line of exercise or instruction he may suggest.

The book is illustrated in a novel fashion by photographs of incidents in ship and shore work having no direct connection with the text, but the book is thereby lightened and the pill well sugared for any juniors who may require a stimulating inducement in their studies.

The Management of Public Electric Supply Undertakings. By A. Hugh Seabrook. 1913. London: *Electrical Times*, Ltd. Price 7s. 6d. net.

Outside the technical details of the practical side of electric supply management, as dealt with in the present book, there are two points of particular interest incidentally raised. The one is in respect of the much debated question of municipal *versus* public company management, and the other in regard to the relative values of the commercial and engineering sides. Taking the first of these points, it is interesting to note the view of the author expressed so very strongly in favour of electricity supply being controlled by companies—especially in view of his lengthy experience of municipal control, covering the Barking, West Ham and St. Marylebone undertakings. On this point, Mr. Seabrook writes as follows:—

"One thing at least is certain, and that is that the proper realisation of the duties and responsibilities of management cannot be present when the board of management no longer consists of men who have big financial interests in the undertaking, and who are mere delegates with no personal responsibility. If the undertaking fails they are practically unaffected, and if, as is quite unlikely, however, it becomes a gigantic success, they are no better off. The absence of profit and risk sharing bars the way to maximum efficiency being obtained."

"These difficulties of municipal management are unavoidable, and it is as a result of them that the municipal public electric service is prevented from reaching its highest efficiency."

The above paragraphs, of course, only touch one of the many cogent arguments which the writer advances against municipal trading. It is interesting, in the broader aspects of this matter, to note that quite recently the consolidation of the electrical interests of Paris (and this under the most enthusiastic Republican *régime*) has been placed in the hands of a company working under concessions modified by limited municipal representation on the administration committee. In Germany, too, where Socialistic feeling is extremely strong, the supply to Berlin is in the hands of a company, and again, in America, the municipal undertakings only amount to 23 per cent., as against 77 per cent. of undertakings of independent companies or syndicates. The foregoing facts indicate the general trend of practice, and it might well be surmised that, if the time were to come over again, a different attitude would be taken by the Parliamentary Committees in respect of their earlier leanings, for some years onward from 1882, towards municipal control.

Then, as to the second point mentioned above, viz., the adjustment of control between the engineering and the commercial sides of the undertaking, until comparatively recently, in the majority of undertakings, it had been assumed that the whole matter of the commercial direction of the business was a more or less subordinate matter, and one which naturally fell into the hands of the engineer. (This obtains, in fact, to-day in the majority of cases where the supply is in the hands of municipalities.) Gradually, however, there has come to be recognised, what any business man would have recognised at first, viz., that the business of electricity supply is primarily a matter purely of trading, and that as such the whole success of the undertaking depends on the commercial handling of it; and that the engineering side, necessary although it may be, must fall into a secondary place.

The very existence of Mr. Seabrook's book—to say nothing of the powerful arguments throughout its pages—

strongly supports this contention. Some of the companies have led the way in this direction, and the sound commercial footing on which they now stand is entirely due to their recognition of the fact that their undertakings had to be directed and controlled by the commercial side, and not to be left to the uncertain handling of the engineering side. The first duty of the latter is obviously the efficient generation and distribution of electrical energy, which, of course, demands entirely different qualifications from those connected with the selling of the product and the running of the concern, as a whole, on proper financial lines. It is the emphasis which this book lays on the importance of the commercial aspect of the undertaking, that gives it its chief value.

The book deals in a businesslike way with the general organisation of the various departments, dividing up the whole of the staff—under a general manager—under four headings: Secretarial (including accountancy), generation, distribution, sales management. With the help of tabulated diagrams, these departments are dealt with in detail in their respective chapters, which give the general framework on which most big undertakings are at present working.

The managers of big undertakings, of course, may have little to learn from the book, but undoubtedly to the engineers of many of the small undertakings, whose ideas of management are perhaps somewhat confused and whose organisation often leaves much to be desired, the clear treatment of the subject will certainly be of assistance in giving them a comprehensive idea of the lines of proper organisation, and helping them to frame some modified system adapted to their own requirements.

Those who demand a modicum of humour may find a reward in searching through a few of the opening paragraphs of the chapters which deal with the ethical side of management, as, for instance, in the enthusiastic pages about the "square deal" and its commercial value, which apparently embody Mr. Seabrook's re-discovery of the value of his copybook maxim of juvenile days—"Honesty is the best policy."

BUSINESS NOTES.

Patent Application.—Application for restoration of Patent No. 14,495, of 1906, for "Improvements in Railway Signalling Mechanism and the Like," has been made by Wm. Reid and the Australian Signal Controller Co. Proprietary, Ltd.

Lead.—In their report dated November 29th, Messrs. James Forster & Co. say that "the great scarcity of prompt lead, which has been so marked a feature for many months past, is at last beginning to show signs of relaxation, and we have little doubt that this is due to a slowing down in consumption in the electrical trade centres (particularly in Germany), which has relieved the strain and allowed more lead to come to London. . . . It cannot be wondered at that the effect of falling trade all over the world is at last telling on the consumption of lead, the price of which is still very high and much above the average of past years."

Montreal Electrical Exhibition. — Our Montreal correspondent writes:—A successful electrical exhibition, under the auspices of the Montreal Electrical Society, was held in the Arena, Montreal, from November 1st to 8th. The majority of the exhibits appealed more particularly to the housewife, but there were some that had a wider and more scientific interest. The Montreal Light, Heat and Power Co. occupied extensive space in the hall, and exhibited electric toasters, stoves, radiators, together with ornamental table lamps, house fittings, &c. The Montreal Electrical Society itself had an interesting booth where, amongst other things, was shown an electrical "museum," consisting of old-fashioned equipment of various kinds. They also showed a seven-roomed house to demonstrate how many economical uses may be found for electricity in the modern home. One of the most interesting stands was that of R. A. Lister & Co., Ltd., Toronto. This firm showed in operation a Lister-Bruston automatic electric lighting plant, designed for house lighting in rural districts. This exhibit attracted considerable attention and was in operation every day, its automatic features being fully demonstrated. Among other exhibitors may be mentioned:—Tate Electrics, Ltd., Walkerville, Ontario, electric motor trucks and automobiles; Eagle Sign Co., Montreal, electric signs; Sayer Electric Co., Montreal, lamps, shades, batteries, wireless telegraphy outfits, &c.; General Film Co., Montreal, motion picture projectors; Schuman Electric Co., lamps, radiators and electrical supplies. The Society for Prevention of Cruelty to Animals showed an automatic electric cage for the humane destruction of dogs. A large number of booths were devoted to the demonstration of vacuum cleaners, washing machines and other household appliances.

Book Notices.—*Central Battery Multiple Switchboards*, a bulletin recently issued by the Peel-Conner Telephone Works, Ltd., is not a price list of the company's products, but a handsome illustrated brochure containing a description of some of the exchange equipments which it has installed at home and abroad, with explanations of the mode of operation employed, and diagrams of the connections. The company prefers 40-volt to 22-volt working for many reasons, and first used it, we believe, at Glasgow. The arrangement of the frames and racks is standardised on improved lines, which enable extensions to be made at the minimum cost, and the innumerable details of the equipment are designed with a view to combining efficiency with long life. The illustrations are admirable.

Dynamo and Motor Attendants and their Machines. By F. Broadbent, M.I.E.E. Seventh edition. London: S. Rentell and Co., Ltd. Price 1s. 6d. net.—This work appears to have definitely taken its place in technical literature as a periodical, for new editions succeed one another at very short intervals. The present issue has been revised and brought up to date, and the title has been altered to include motor attendants, while the author even threatens to bring accumulator management "and other matters pertaining to installation work" within its covers. We should advise him not to spoil a good thing by overloading it. At present the book is unique of its kind, and it is hard to find food for criticism or scope for improvement; it admirably fulfils the purpose of a practical handbook for the guidance of the classes of readers indicated in the title.

"*Mechanical World* Electrical Pocket-Book for 1914." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Annual Report of the Royal Technical College, Glasgow." Glasgow: The College.

"*Engineering* Directory." October, 1913. London: *Engineering*, Ltd. Gratis.

"*Journal* of the Society of Engineers." Vol. IV, No. 11. November, 1913. London: The Society. Price 1s. 3d., post free.

"*Transactions* of the New York Electrical Society." June-October, 1913. New York: The Society.

"Manufacture of Lime." By W. E. Emley. Washington: Government Printing Office.

"Boletin de Ingenieros." Vol. IV, No. 2. October, 1913. Mexico: Departmento de Ingenieros de la Secretaria de Guerra.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 223. London: E. & F. N. Spon, Ltd. Price 3s. 6d.

"Small Power Wireless Installations." By Maurice Child. Price 1s. net. "The Motor-Cyclist's Handbook." Price 2s. net. London: Percival Marshall & Co.

Liquidations.—The Electromobile Co., Ltd.—A petition for the winding-up of this company has been presented by Lawrence Fletcher, gas engineer, and will be heard on December 9th.

Sun Power Co. (Eastern Hemisphere), Ltd.—A meeting of creditors is called for to-day (December 5th), at Friars House, New Broad Street, London, E.C., at 12 o'clock noon, by the liquidator, Mr. F. S. Fitzer.

Warren Beattie & Co., Ltd.—This company is winding-up voluntarily with Mr. F. J. Forster, of Albert Chambers, Albert Road, Middlesbrough, as liquidator. A meeting of creditors is called for December 10th, at the liquidator's offices.

New York Belting and Packing Co., Ltd—A meeting will be held at 91, Chambers Street, New York City, U.S.A., on January 15th, 1914, to hear an account of the winding-up from the liquidator, Mr. J. H. Cobb.

Safety Light, Ltd.—On November 24th voluntary liquidation was resolved upon. Mr. P. J. Goodchild, the liquidator, has issued a circular in which he says that there is no possibility of any return to unsecured creditors. A realisation of the whole assets will result in a considerable loss to the debenture-holders. A meeting of creditors is called for December 11th at Winchester House, E.C.

Advertising as a Career.—At the Kingsway Hall, Kingsway, on Monday evening, Lord Desborough presiding, Mr. Thomas Russell delivered an address on "Advertising and Selling as a Career." The meeting was held to inaugurate a "National Movement to Promote Efficiency in Advertising and Selling," conducted under the auspices of the International Correspondence Schools.

Electrical Competition in Australia.—The *Sydney Morning Herald* in October last published the following:—"Complaint is made that an unfair advantage against foreign electric firms is being taken of the tender system. It is stated that tenders are invited for the supply of electric material, and that German tenders are generally the lowest, but that they do not get the contract, which is given to an English competitor. Statements have even been made that English tenderers have been allowed to bring their prices down to the neighbourhood of the German quotation. If this be the case, then undoubtedly the German tenderers are being treated unfairly. Whatever be the practice, however, that practice is having its effect on German firms, who, in some instances, have refused to quote prices for business which would amount to thousands of pounds, as they considered that they were being made use of for the benefit of English manufacturers."

Catalogues and Lists.—Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—Phœnix *Bulletin*, No. 8A, is a 12-page publication containing an illustrated description of a new type of machine for dealing with large currents for electrolytic purposes and for boosting. The theoretical principle upon which the machine is designed is considered, an explanation being given of the half-turn winding and of the special precautions adopted in order to deal efficiently with very large currents generated and carried off from the commutator. Illustrations are given of large electrolytic plants, including a dynamo for 7,000 amperes, also some large boosters. Copies of the *Bulletin* can be obtained on application.

Messrs. Isenthal & Co., Denzil Works, Neasden, London, N.W.—List No. 25AI is an excellent catalogue of 104 pages, in which is given fully-illustrated information, with prices, &c., of the firm's rheostats. The several sections deal respectively with (1) slate (single, twin and universal), (2) tubular and (3) cinema and arc lamp and sundry type rheostats. The illustrations include many explanatory diagrams of connections, and prices are set out in tabular form with great clearness. These resistances have now been thoroughly standardised, and the firm are keeping a large stock at Neasden where they are manufacturing every type of experimental and loading resistance, apart from those actually shown in the catalogue. We understand that the sales in this department have increased during the last three years in geometrical progression, and many new forms have been listed, while attention has also been paid to the ever-growing requirements of some of the more recent developments of the electrical industry, such as radio-telegraphy and high-frequency work generally.

Messrs. Major, Smith & Stevens, Ltd., Abbey Works, Northampton.—We have received a copy of the latest edition (the fourth) of the firm's illustrated brochure entitled "Notes on Electric Lifts." It contains a good deal of interesting material which should be of service to those interested in the installation and operation of lifts, and in addition to excellent half-tone illustrations of the electrical equipments themselves, it contains pictures of a number of important public buildings at home and abroad where the firm's electric lifts are in service. These premises include the British Electrical Federation Building and the Institution of Civil Engineers in London, also a theatre in Shanghai, while the H.M.S. *Orion* and her six engines and controllers are likewise pictured. Records of actual results showing economy in cost of power and repairs, methods of driving and control, the full automatic system, and accessibility, are all referred to, notes on the winding engine, position of worm, thrust bearings, wheel drive, automatic electric locks, safety gears and their position, and many other points, following. The publication (106 pages) winds up with an imposing selected list, extending over a number of pages, of purchasers and users.

Mr. O. N. Beck, 11, Queen Victoria Street, London, E.C.—Four-page list containing a full description, with illustrations, and a number of line diagrams, of the "Vapor" patent scale collector for use in boilers.

Messrs. John Spencer, Ltd., Globe Tube and Engineering Works, Wednesbury.—Trade price list of wrought-iron tubes and fittings, also iron and steel boiler tubes and accessories.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, London, W.C.—Leaflet No. 3,001 gives prices of double and triple-pole ironclad switches (house-service type) for from 15 to 100 amperes.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—The company has issued a new "Osram" lamp show-card, copies of which will be supplied free to all electricians, ironmongers, and stores on application.

Messrs. Isaria, Ltd., 208, Tower Bridge Road, London, S.E.—Illustrated lists with descriptive particulars, prices, weights, dimensions, &c., of Isaria A.C. watt-hour meters, and bell transformers.

Messrs. Woolnough, Lang, Ltd., London.—This firm has now shut down its Norwich premises and is fully established at Wales Farm Road, Acton, London, W. Two illustrated price lists have been issued dealing respectively with rotary transformers and motor-generators, and petrol and paraffin electric sets.

Bankruptcy Proceedings.—H. G. Prested, electrical engineer, Elthorne Road, Upper Holloway.—Under a receiving order made against this estate, the first meeting of creditors was held last week at the London Bankruptcy Court before Mr. Egerton S. Grey, Official Receiver. It appeared that the debtor was appointed in 1893, at a salary of £500 per annum, managing director of the company formed to develop a system of ignition for motor-cars. The undertaking was successful until 1908, when the system was superseded by a magneto ignition. Although other inventions had since been put on the market they were not successful, and in October, 1911, the assets of the company (Prested Miners' Gas Indicating Electric Light Co., Ltd.) fell into the hands of the debenture-holders, who appointed the debtor to the post of Receiver at a weekly salary of £7 7s. That appointment terminated in April, and the company had gone into liquidation. The debtor had held £8,000 shares, a large number of which were bought and paid for by himself. There was no prospect of any dividend being paid to the shareholders. Four years ago the debtor entered into an agreement to purchase a business in Windsor Road, Holloway, and paid £100 as a deposit; he failed to complete the purchase and judgment had been recovered against him for a balance of between £500 and £600. The debtor attributed his failure to the action of the debenture-holders and the collapse of the Prested Miners' Gas Indicating Electric Light Co., Ltd. He returned liabilities £170 and assets "nil." The case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

Frederick Wm. Chamier, mining and electrical engineer, 59, Fleet Street, E.C.—The adjourned first meeting of creditors was held on Monday, at the London Bankruptcy Court, under this failure. Mr. E. Leadham Hough, Senior Official Receiver, reported that a statement of affairs had been lodged showing assets to the value of £18,500, and liabilities only £511. The meeting had stood adjourned to enable the debtor to submit an offer for the consideration of the creditors, but none had been lodged. Asked if he thought the assets would realise the amount placed upon them the debtor said they ought to do so within 18 months. They included a claim of £76,000 against a foreign electrical company which was in course of liquidation, and from which he expected to receive a substantial dividend. In the absence of any definite proposal, Mr. E. H. Hawkins, I.A., was elected as trustee to administer the estate in bankruptcy.

Roger W. Wallace, K.C., Kensington.—The sitting of the Bankruptcy Court for the public examination in this matter has been further adjourned to December 16th, as a scheme of arrangement is being put before creditors.

J. D. Nixon (J. D. Nixon & Co.), electrical and mechanical engineer, Crewe.—December 18th is the last day for receipt of proofs for dividend by Mr. F. T. Halcomb, Official Receiver, King Street, Newcastle, Staffs.

W. Wadsworth, engineers' agent and dealer in electrical accessories, Chorlton-cum-Hardy, Manchester.—A first and final dividend of 1s. 4½d. in the £ is payable on December 9th at the Official Receiver's offices, Byrom Street, Manchester.

Australian Electrical Trade.—According to a Sydney newspaper a contract has been let for the erection of new large premises to be occupied by the Australian General Electric Co., at the corner of Goulburn Street and Wentworth Avenue, Sydney. The premises will consist of glass enclosed showrooms, storage floors, and office accommodation in a brick building having 120 ft. frontage to Goulburn Street, and a frontage to Wentworth Avenue of 76 ft. The floors are specially constructed to carry the heavy loads necessary for the storage of machinery. The building is to be completed in nine months.

Trade Announcements.—Messrs. Handley and Robinson, Ltd., have commenced business as electrical and general engineers at 27, South King Street, Dublin, and they will specialise in country house plants. Manufacturers are invited to forward lists, &c.

Messrs. Morris & Lister (London), Ltd., of Palace Chambers, Westminster, announce that their telephone exchange and number have been changed, and are now: "Victoria 7844."

Strike in America.—A daily paper states that between 5,000 and 7,000 employés of the General Electric Co. at Schenectady recently struck work owing to a dispute caused by the discharge of a Trade Unionist.

Canada.—H.M. Trade Commissioner for Canada (Mr. C. Hamilton Wickes) reports that a company in Montreal wishes to secure the agency of United Kingdom manufacturers of electrical supplies and fittings.—*Board of Trade Journal.*

LIGHTING and POWER NOTES.

Accrington.—Plant Extensions.—The Electricity Committee has considered the proposed extensions of plant at the electricity works, and has instructed the electrical engineer to get provisional tenders for additional gas plant. Ald. Higham (chairman) informed the Committee that during the next year there would be an additional consumption by new consumers to the extent of some 900 kw. The outside margin at present was only some 400 kw. with every particle of plant at extreme output, and it would be absolutely necessary to have additional plant installed by October next year. It is reported locally that the scheme for extensions which it is proposed to submit will involve an expenditure of from £40,000 to £50,000.

Australia.—Two more Victorian Shire Councils have decided upon electric lighting for their principal towns, viz., the Numurka Shire, to light Nathalia, at an estimated cost of £4,000; and the Warranga Shire, to light Rushworth. Messrs. McCarty, Underwood & Co., of Melbourne, have been appointed to carry out the work in each instance.—*Australian Mining Standard.*

Barnsley.—The T.C. is seeking powers to provide, purchase, sell, let for hire, fix, repair and remove electrical fittings and apparatus, and to enter into contracts with consumers.

Barrow.—The electrical engineer has reported that owing to the large increase in the number of consumers in the Abbey Road district, and the prospect of a still further increase due to the opening up of other land for building purposes, it would soon be necessary to consider some rearrangement and extension of mains in that neighbourhood. The electrical engineer further reported upon the terms which the chairman and himself had provisionally agreed to with the Walney Island Estates Co., with regard to the Corporation taking over the meters in their houses in North and South Vickerstown. This was approved.

Bacup.—LOANS SANCTIONED.—The L.G.B. has sanctioned the following loans in respect of the electricity undertaking:—£700 for station equipment and £2,100 for mains.

Bedford.—L.G.B. INQUIRY.—On November 25th, Mr. T. C. Ekin held an inquiry into the application of the T.C. for sanction to borrow £10,000 for electrical extensions. According to the *Bedford Times* the latter include a turbine set, water-tube boiler, condensing plant, switchgear, air filter, &c. There was no opposition, and the inquiry was closed.

Bexley.—At a meeting of the U.D.C. on November 26th, it was reported that the Woolwich B.C. would be willing to consider any amended proposal which the Bexley Council might desire to place before it with reference to a bulk supply of electricity from Woolwich. The Bexley Council had previously intimated that no advantage would be gained by either Council from further consideration of the matter, and no further action was taken.

Bispham.—The U.D.C. has resolved that after the present quarter it will enforce the payment of the minimum charge of 3s. 6d. per quarter.

Bradford-on-Avon. — PROV. ORDER. — Mr. J. H. Edwards, electrical engineer, of Bristol, is applying for a prov. order for E.L. within the area of the U.D.C.

Brazil.—The new hydro-electric station of the Compania Industrial de Electricidade at Parahybuna, has lately been completed. The plant comprises two Voith turbines, of respectively 3,300 H.P. and 1,200 H.P., coupled to three-phase generators working at 6,000 volts. The current generated is transmitted to a number of towns within a distance of 200 miles, transformer stations being located at Entre Rios, Avellar, Valenca, Ipiranza, and Palmeyras. The current is stepped up for transmission purposes to 30,000 volts, and then reduced to 6,000 volts, and, for distribution, to 200 and 120 volts.

Bristol.—The T.C. has reduced the price of electricity for heating purposes to 1d. per unit.

Brymbo. — PUBLIC LIGHTING. — The Denbighshire C.C. has granted a loan of £300 to the Brymbo P.C. for the purpose of a public lighting scheme. The Council has received a favourable offer for the supply of electricity from the Brymbo Steel Co.

Canada.—It is proposed to build at Vancouver a municipal electric lighting and power plant at a cost of $300,000. Current is to be generated by turbines driven with steam generated in boilers with oil-burning furnaces. A gas plant is also being considered.—*Canadian Engineer.*

According to the *Canadian Electrical News*, the following towns have passed by-laws to expend the sums mentioned on extensions to their electric light systems:—Fergus, Ont., $16,000; Outlook, Sask., $10,500; Brockville, Ont., $69,000. St. Catherines, Ont., has decided to expend $116,000 on a step-down transforming station and distributing system.

POWER DEVELOPMENTS IN MONTREAL AND DISTRICT.—Hydro-electric development in the Montreal district has made rapid strides of late, and is on a scale that anticipates a large demand for power in the near future.

The Laurentide Co.'s new plant, which is expected to be completed by next spring, will increase the development at Grand-Mere to 80,000 H.P., which can be further brought up to 100,000 H.P. at comparatively low cost. A considerable portion of this power will be available for purposes outside of those of the company; the present development at Grand-Mere is 22,000 H.P.

The Cedar Rapids plant, with an initial capacity of 100,000 H.P., and 160,000 H.P. aimed at ultimately, will, according to the latest reports, be ready by the autumn of 1914, according to the original plans.

With both the Cedars and the new Laurentide plants in operation and the extension this summer completed at Shawinigan, the hydro-electric development in the district of which Montreal is the centre should be upwards of 400,000 H.P. by the end of 1914.

This is exclusive of the plans of the National Hydro-Electric Co. at Carillon, of which comparatively little has been heard recently, but which aim at a development of 160,000 H.P.

The Montreal Light, Heat and Power Co.'s water-powers at Chambly, Soulanges and Lachine, the Canadian Light and Power's plant at St. Timothee and smaller plants account for 100,000 H.P. in addition.

Chorley.—PROV. ORDER.—The T.C. has decided to consent to the proposed application by the Lancashire Electric Power Co. for a prov. order to supply electricity for lighting purposes within the borough, provided satisfactory clauses are embodied safeguarding the future interests of the Corporation.

Cleethorpes.—A recommendation to extend the electric light mains was severely criticised at the last meeting of the Council. Councillor Moody thought it was the height of folly to extend the mains when they were losing from £300 to £400 a year on the undertaking at present. Councillor Turner said they had this year nearly used half the amount they had agreed to take from the Grimsby Tramways Co. They were establishing a destructor and pumping station at Cleethorpes, and it would not be a difficult thing to make their own electricity. Eventually the Council adopted the recommendations.

Continental Notes.—AUSTRIA.—A big water-power installation in connection with a factory for the production of carbide of calcium and cyanide of potassium will shortly be in operation near Spalatro and Almissa, in Dalmatia. The installation, with that on the Kerka River, will have a joint output of 75,000 H.P.

The Electrotechnische Verein, of Vienna, has been agitating for relief from the restrictions imposed on electrical transmissions, and urges that legal powers should be given to use public and private lands and highways for electrical purposes, and to prevent obstruction by private individuals and others. The matter has been discussed for the last five years, and legislation has frequently been promised.

GERMANY.—To show the advantages of the use of electric motors, the Berlin Bureau for the Propaganda of Electricity publishes the following statistical figures: In 1895 there were in use in Berlin 1,010 gas engines and 250 electric motors; in 1911 the figures were 422 gas engines and 26,669 electric motors. According to the latest statistics only 317 gas engines are now in use.

Dartford.—The assistant district auditor states that there is a loss on the electricity undertaking for the year ended March 31st last of £1,290, as against a profit of £191 in the preceding year. This is attributed to an increase of 44 per cent. in the price of coal, to the cost of redemption of capital expended on plant unproductive until after the close of the year, and to a decrease in sales for power purposes. There remains invested and allocated to reserve a sum of £1,000, which does not leave a working balance on revenue account, the treasurer being overdrawn to the extent of £569.

Darwen.—Messrs. John Catlow & Sons, Ltd., are proposing to adopt electricity for motive purposes at Olive Mill.

Dublin.—PROPOSED ELECTRIC COOKING.—At a recent meeting of the North Dublin Union, a report was submitted which showed that for three years prior to the use of electricity, the cost of gas for lighting only was £956 per annum; the average cost of electric lighting over three years was £779, showing a saving of £177 per annum. It was suggested that electricity might also be used for cooking with advantage, and consideration of the matter was referred to the Ladies' Committee.

Dundee. — BROUGHTY FERRY SUPPLY. — Following upon a breakdown of the electricity supply on Monday, last week, in the recently annexed burgh of Broughty Ferry, a report has been prepared by Mr. Harry Richardson, the electrical engineer, which states that it would be opportune to mention generally the condition into which the plant had been allowed to deteriorate. The battery was absolutely useless; every pump in the place, without exception, was in a very inefficient state, and the condenser required immediate attention. There was hardly a valve in the place which would hold tight, and the condition of those taken out must be seen to be believed. The back of the switchboard was in a state of chaos, and as regards the cable and distribution things were little better.

Mr. Richardson reminded the Electricity Committee in his report, that it was his intention to make Broughty Ferry a sub-station, supplied with high-pressure current. It would, however, be March at the earliest before the necessary machinery could be delivered and the supply connection completed.

In his opinion the depreciated state of the Broughty Ferry station plant rendered a cessation of the electricity supply inevitable.

Exeter.—PROPOSED REFUSE DESTRUCTOR PLANT.—The T.C. has decided to have a report prepared as to the power likely to be derived, and the use which might be made of such power, from a refuse destructor proposed to be erected at the St. Thomas Sewage Works.

Frensham.—PROV. ORDER.—The Farnham Gas and Electricity Co. is applying for a prov. order to supply electricity in the parish of Frensham, which is at present in the area of the Hindhead E.L. Co.

Gillingham (Kent).—L.G.B. INQUIRY.—An inquiry was held on November 26th into the application of the T.C. for a loan of £7,000, of which £5,343 was for a second Diesel engine set the first one installed having proved very economical as compared with steam power. There was no opposition.

Hoyland.—The U.D.C. has decided on a scheme for lighting the town with electricity.

Ilford.—NEW PLANT.—With reference to the proposed sub-station at Goodmayes, the electrical engineer has been authorised to inspect similar sub-stations recently erected at Southend, and proceed with the specification of the requisite battery and plant.

India.—It is notified in the *Punjab Gazette* that a licence for the supply of electrical energy in Lahore Municipal area, granted to the People's Bank of India, has been transferred to the Lahore Electric Supply Co., Ltd.—*Indian Engineering.*

Japan.—During the month of October last a total of £120,500 was invested in the electrical industry in Japan, £20,000 being in respect of new companies, and £100,500 for the extension of existing undertakings.

Kenmare (Co. Cork).—Owing to a breakdown in the cable supplying current to Kenmare, the town was in almost complete darkness for four days last week.

Limerick.—At a meeting of the Electric Light Committee on November 29th, the question of the loss in the working of the undertaking was under consideration, and it was decided to recommend the Corporation to increase the charge for lighting from 5d. to 6d. per unit, with certain discounts. No advance was recommended in the price for power purposes.

Liverpool.—NEW LOANS.—Application is to be made to the L.G.B. for sanction to the borrowing of £10,000 for the provision of sub-station equipment.

London.—BERMONDSEY.—The B.C. is taking up a loan of £4 000 from the L.C.C. for mains and plant.

MARYLEBONE.—The B.C. has received the approval of the B. of T. to supply electricity at extra-high-pressure.

L.C.C.—The Council has rescinded the resolution as to £4,230 for the electricity undertaking of the Woolwich B.C., the latter not desiring to take up the loan.

The Council, at its last meeting, sanctioned the following loans:—£15,500 for coal storage tanks and transporting plant, for the Hammersmith B.C. electricity undertaking; £17,226 for electricity purposes for the Shoreditch B.C., made up as follows:—Mains, £5,000; transformers, £10,000; switchgear, £1,800; and engineer's charges, &c., £500.

LONDON'S ELECTRIC SUPPLY.—At the same meeting of the L.C.C., the chairman of the London Electricity Supply Committee (Mr. G. H. Hume) was asked whether he was aware that the County of London Electric Supply Co. had obtained a provisional order to acquire an option of a site comprising 23 acres of land between Barking Creek and the borders of Dagenham; whether he was aware that this site was the only one available for such a purpose; and whether this granting of a provisional order was likely to prejudice any scheme of the Council, and the interests of those boroughs that generate and supply their own electricity. Mr. Hume said, in reply, he was advised that the Council's only locus as regards the provisional order was in respect to its power of purchase, and that the Council had no locus in regard to the purchase of a site by the undertakers, and could not raise the question before a Committee of Parliament. So far as the Council's purchase powers were concerned, the question was dealt with, and the Council's interests were safeguarded. The valuer had stated that he was not aware that the scheduled site was the only land in the neighbourhood of London suitable for the purpose.

Maidenhead.—WORKHOUSE LIGHTING.—The T.C. has decided to comply with the request of the B. of G. for a supply of electricity for lighting and power at the new workhouse laundry, and to extend the main at a cost of £150.

Minehead.—The local electric supply company has introduced a scheme for outside shop lighting, with metal lamps of not less than 200 C.P. Current will be supplied at 2d. per unit, plus a fixed charge varying from 21s. per annum for 200 C.P., to 60s. for 1,000 C.P.; two 100-C.P. units can be used together or in separate fittings for the lowest C.P.

Morocco.—A concession, it is stated, has lately been granted for the establishment and working of an electric lighting station in the town of Tetuan; the *Board of Trade Journal* says, it is understood that two syndicates have applied for concessions, one for an electric tramway for goods transport between Tetuan and Rio Martin.

Newcastle-on-Tyne. — DUNSTON EXTENSIONS. — In order to cope with the increased demand for power and the steadily increasing load, the Newcastle-on-Tyne Electric Supply Co., Ltd., has decided to extend the power station at Dunston-on-Tyne. This station generates three-phase current at 6,000 volts and 40 cycles. The steam pressure is 200 lb. per sq. in. superheated to 570° F. The main generating units at present consist of two A.E.G. sets, each of 10,500 H.P., and a Brown, Boveri set of 9,000 H.P., all three running at 1,200 R.P.M. The station was originally laid out to eventually accommodate six generating units, each of 10,000 H.P. continuous capacity, and 13,000 H.P. maximum capacity, or a total capacity of about 70,000 H.P. In connection with the present scheme an agreement has been entered into with the Teams By-Product Coke Co., Ltd., which is now engaged upon the installation of a large battery of Otto-Hilgenstock coke ovens on a site about 1½ miles distance from the Dunston power station, to purchase its available coke oven gas. This gas will be led along the N.E.R. Co.'s Dunston branch in a 16-in. welded steel pipe, which will be supplied by Messrs. Stewarts & Lloyds, Ltd.; the joints will be welded *in situ* by the acetylene process. The boiler house extensions comprise a steel frame building, sheeted in with corrugated iron, 114 ft. long × 75 ft. wide, and two steel chimneys. There will be two coal-fired water-tube boilers, each rated at 30,000 lb. of steam per hour, with the necessary furnace and flue fixtures, also stokers and superheaters. In addition, there will be four gas-fired water-tube boilers, each capable of dealing continuously with 57,000 cb. ft. of gas per hour, to be built in two batteries, with the necessary flue fixtures of same, inclusive of gas burners and superheaters. The fuel economisers, one for each boiler, will have automatic tube scrapers and flues and dampers, also soot cleaning gear. Induced draught fans will deal with the products of combustion from the boilers. There will be two feed pumps, each capable of dealing with 200,000 lb. of water per hour. The coal-handling plant will feed the overhead bunkers at the rate of 40 tons per hour, and will receive coal from two hoppers, each of 25 tons capacity, traversed by a railway track. The overhead bunkers will have a capacity of 950 tons. All the boiler house plant and buildings have been contracted for by Messrs. Babcock and Wilcox, Ltd., and the whole of these buildings will be placed on a 6 ft. 6 in. reinforced raft supported on pitch pine piles, which work has been executed by Messrs. Robert McAlpine and Sons, Ltd., of Glasgow. The engine room plant extensions consist of a 12,000-KW. turbo-alternator with direct-coupled exciter, the turbine being by Messrs. Richardsons, Westgarth & Co., Ltd., and the alternator by Messrs. Brown, Boveri & Co. The surface-condensing plant includes of a Contraflo condenser capable of dealing with 141,600 lb. of steam per hour.

New Southgate.—At a public meeting held under the auspices of the New Southgate Tradesmen's Association and the Friern Barnet Ratepayers' Association, it was resolved that, in view of the high price of gas in the district, the Ratepayers' Association should ascertain what support would be forthcoming from intending consumers, with a view to obtaining a supply of electricity from the North Metropolitan E.P.S. Co.

New Zealand.—The Manukau C.C. is applying to the Government for permission to harness the Hunua Falls for the supply of electricity.

Plymouth.—YEAR'S WORKING.—The electrical engineer's annual report shows that for the year ended March 31st the gross profit was £15,560, an increase of £2,197 over the previous year; 152 additional consumers were connected during the year, and the number of motors had increased from 210 to 248; £1,542 was placed to the credit of the reserve fund, which now stands at £11,423.

The Electricity and Street Lighting Committee has decided to exercise the sanction of the L.G.B. to borrow £5,500 for extensions of plant.

Purley.—Owing to a fault in one of the cables, a failure of supply occurred on Tuesday evening, which affected Purley, Kenley, Woodcote, Coulsdon and Wallington.

Redditch.—A very lengthy discussion has taken place on certain recommendations of the Advisory Sub-Committee, which were deferred when a report was presented in March last. The debate centred largely round a proposal to increase the price to power consumers, which was strenuously resisted by the works manager, who pointed out that there were running agreements with several large firms, from whom the revenue amounted last year to £3,170 out of a total of £8,331. In the end an amendment was carried that the question of revision of power rates should stand over until next March.

Reigate.—L.G.B. INQUIRY.—On November 27th an inquiry was held relative to the Corporation's application for a loan of £1,500 for electric light purposes, viz., transformers, mains, house services, £265 overspent on a loan to meet the cost of cable extensions on the Reigate Lodge Estate, which is being developed for building. There was no opposition.

Ripon.—PROV. ORDER.—The T.C. has decided to apply for a prov. order for electric light within the city. The compulsory area is to include 14 of the principal thoroughfares.

Rushden.—ELECTRIC SUPPLY INAUGURATED.—The formal opening of the works of the Rushden Electric Supply Co., Ltd., which is supplying energy in the Rushden and Higham Ferrers areas, took place last week. The new concern is an off-shoot of the Northampton E.L. Co., with Mr. G. H. Jackson as engineer, and the price charged for energy to local manufacturers for power purposes is within 5 per cent. of that charged at Northampton.

GENERATING PLANT.—This consists of two four-cycle three-cylinder "Willans-Diesel" engines, each driving a 160-KW. E.C.C. dynamo; also a combined balancer booster, capable of dealing with 100 amperes out-of-balance current, and each booster to give 120 amperes at 90 volts. There is also a motor-driven auxiliary air compressor and battery milking booster. The main oil storage tanks are situated in the yard, and oil is pumped direct from the railway tank wagons in the goods yard adjoining the company's property. The three-wire switchboard is one step above the engine room floor level, all the rheostats being of the pedestal type, and arranged some 4 ft. away, along the front of the switchboard. The battery room contains two batteries, each of 120 cells, by the Tudor Accumulator Co. The present capacity is 340 ampere-hours, but the cells are large enough to allow for doubling the number of plates; they are operated by automatic charge and discharge battery switches on either side of the three-wire system, all the switchgear being by Messrs. Bertram Thomas. There is also a combined general office and showroom; and a private office and stores. All the distributing mains are vulcanised bitumen, laid solid, 2¾ miles having been already laid. All the feeders are drawn into stoneware ducts, ample provision being made for future developments.

Shipley.—PROPOSED LOANS.—At a special meeting of the Council this week it was decided to apply for power to borrow £27,000 for the purposes of the electricity undertaking.

Stapleford (Notts.).—NEW GENERATING STATION.—The Derbyshire and Notts. E.P. Co. has acquired a site in Nottingham Road, with a view to the erection of a power station for the supply of electric light to Stapleford and Sandiacre.

Sturry (Kent).—E.L. SCHEME.—A meeting of the P.C. was held on November 25th to consider the electric light proposals put forward by a company for Sturry and adjoining parishes. It was stated that the company, which proposes to establish a generating station at a local water mill, offered to supply current

for lighting at 4½d. per unit, and for power at 1½d., by means of overhead wires. Houses would be wired free, and the cost would be 3d. per 15-C.P. lamp. The Council decided to support the scheme, and to make no objection to the use of overhead wires.

Swansea.—Asylum Lighting.—The Corporation has offered to supply current for lighting the new asylum at 2½d. per unit up to 100,000 units per annum, and the acceptance of this offer has been recommended to the Joint Asylum Committee for Swansea and Merthyr in preference to having an independent plant at the asylum. The whole matter has been referred to a committee, owing to diverse views on the subject.

Swindon.—L.G.B. Inquiry.—On Tuesday, last week, Mr. H. R. Hooper held an inquiry into the application of the T.C. for sanction to borrow £9,300 for the provision of a 500-KW. mixed-pressure turbine, surface-condensing plant, cooling tower, water softener, &c. There was no opposition.

Thurnscoe.—Prov. Order.—The U.D.C. has agreed to apply to the B. of T., in conjunction with the U.D.C.'s of Wath, Wombwell, and Bolton for a prov order. for electric lighting to be employed in connection with the light railway scheme for which powers are being sought from the Light Railway Commissioners.

Warrington. — Proposed Loans. — The electrical engineer has been requested to prepare a report on the lighting of the Aikin Street Hospital and a specification for its improvement. Application is to be made to the L.G.B. for sanction to borrow £14,550 for the extension of the electricity works and plant.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—At a meeting of the T.C. on Monday, the general manager of the tramways recommended the adoption of the P.A.Y.E. type of car over the whole system. As the result of his observation of the working of the experiment on the Woodside section during the past six months, he says he has no hesitation in recommending the new style of cars as an improved method of tramway operation by which greater public safety can be obtained. The prepayment of fares, he also says, has a direct influence on the finances. The total increase for the 21 weeks on the Woodside section, where the P.A.Y.E. cars have been on trial, is £487. A great deal of extra revenue, he says, is due to the prepayment of fares, and to the fact that the conductor is in a better position to see all intending passengers. The Council agreed that in the meantime the general manager should be authorised to invite tenders for bodies of the P.A.Y.E. type for six new cars recently sanctioned, and that the report by the manager should be forwarded to the B. of T., and application made for the sanction for permanent use of the P.A.Y.E. cars on the Corporation system.

Argentina.—According to the *Financier*, the underground line of the Anglo-Argentine Tramways Co. in the centre of Buenos Ayres, the first line of its kind in South America, was officially inaugurated on Tuesday by the President of the Republic.

Australia.—The N.S.W. railway and tramway power house at White Bay (Sydney) is designed to accommodate plant of 100,000-120,000 H.P. At the present time about half the buildings are erected; these will measure 465 ft. by 242 ft., and include turbine, boiler and switch-houses. Three 7,000-KW. Willans-Dick, Kerr turbo-alternators, 750 R.P.M. and a 7,500-KW. General Electric (U.S.A.) impulse turbine, 1,500 R.P.M.; condensing water is obtained from the bay through concrete tunnels fitted with revolving screens to catch the floating rubbish. Four Babcock boilers each for 27,000 lb. per hour normal, or 37,000 lb. per hour forced rating, are being provided for each turbine. A chimney with the Prat system of induced draught will be provided for each pair of boilers, and as at present arranged there will be 16 chimneys. Among the districts to be supplied will be North Sydney, to which cables for 60,000 H.P. are to run through a tunnel between Long Nose Point, Balmain and Greenwich. The whole scheme has been designed in the office of the Electrical Engineer for Railways and Tramways.

Disagreement exists between the Railway Commissioners and Harbour Trust Commissioners as to the site for the power station for the Melbourne railways electrification; the Railway Commissioners, however, consider that there will be no delay in construction owing to this, as the plant will not arrive until next year. The Commissioners state that the contract with Messrs. C. A. Parsons & Co. contained a definite order for four 10,000-KW. generating sets complete, representing a total capacity of 40,000 KW., and included a provision that two additional 10,000-KW. sets, to make the station of the capacity of 60,000 KW., provided for in Mr. Merz's complete scheme, could be ordered by the Commissioners at any time within two years from the date of the contract, January 1st last. The contract which was entered into with Messrs. Babcock & Wilcox for the power station buildings and boiler equipment for one boiler house also included a similar provision in respect of the second boiler house required, to correspond with the increase in the generating plant. In view of the decision of the Government that all the power required for the railway electrification scheme should be generated at the railway power station, it became necessary for the options for the additional plant, &c., held under these contracts, to be exercised, and the cost involved, which is included in the estimates submitted by Mr. Merz, will be approximately £232,000. The additional plant will probably be erected in the early part of the year 1915.

Belfast.—The Bonus Surcharges.—The Irish L.G.B. auditor some time ago disallowed a sum of £2,800 distributed among the tramway employés under a profit-sharing agreement drawn up by the general manager. He accordingly surcharged the members of the Tramways Committee who signed the cheques. Strong representations were made to the L.G.B., and at a meeting of the Corporation on Monday it was announced that the surcharge had been remitted, on the ground that "the subject matter of the surcharge was made in such circumstances, as to make remission fair and equitable."

Bradford.—Half Year's Figures.—The tramways undertaking for the half-year ended September 30th shows a profit of £21,178, against £25,997 for the corresponding half of last year. The income was £153,259, an advance of £9,901, but working costs had increased. The increase in the cost of electricity was £24,600, as against £22,500. This was due to an increase of 122,000 car-miles. The trading profit was £48,677, being £5,699 less than in the corresponding half-year of 1912.

Brighouse.—The Yorkshire (Heavy Woollen District) Tramways, Ltd., last week held an experimental run with a new motor-'bus at Brighouse. It is proposed to establish a service between Brighouse and the terminus of the Dewsbury tramways at Shepley Bridge, and, although arrangements for such are not yet completed, it is hoped that facilities will be made available for the residents of the Rastrick side of the borough of Brighouse.

Bury.—The Tramways Committee has decided that the Limefield section of tramways be extended to the New Inn at Walmersley, and the Jericho section to the borough boundary at Smethurst Hall Farm.

Carshalton. — Electric Vehicle Costs. — At the Queen Mary's Hospital a Cedes electric vehicle is in use for carrying food, milk, laundry baskets, &c., to and from the cottage blocks. The van has a carrying capacity of 30 cwt., and cost £499; the running expenses for one year amounted to £249, including £30 for energy, £28 for battery maker's charges, £3, acid, &c., engineer's services £17, tires £25, porter's services £146, these details being published in a recent issue of the *Hospital*. Unfortunately no details are given as to the method on which these figures have been computed, nor as to the car-miles run.

Continental Notes.—Austria.—In the Vienna municipal Council on November 11th, consideration was given to a scheme for building an electric railway from Vienna to Brünn, the provincial capital of Moravia, a distance of 70 miles, which is to be carried out by the Gemeinde, of Vienna. Current will be supplied as far as the Austrian border by the Vienna Electricity Works, and in Moravian territory beyond, by the Rossitzer Elektricitätswerke.

In recent times, says the *Zeitschrift für das Gesamte Turbinenwesen*, rumours have been current that the Austrian State Railways Administration had been surveying the water-powers of the Alpine lands, with a view to reserving them for the projected electrification of the railways. As a matter of fact, the introduction of electric traction is not an actual question, owing to the situation of the State's finances and the present high rate of interest. The studies with respect to single sections will, however, be continued, with a view to facilitating electrification at a more favourable period.

The Austrian State Railway authorities are at present engaged in installing plants for the better ventilation of the various long railway tunnels in the country. The plants are all electrically operated, among those lately completed being that in the Tauern tunnel, about 5 miles long, and another in the Dossen tunnel, about half-mile long, near Malinitz, Carinthia. The necessary electrical energy for both tunnels is supplied by the power station at Lassach.

Russia.—A company has lately been formed in Moscow, with a capital of £84,300, to construct and work an electric railway, about 9 miles long, between that city and Odinzowo.

La Société des Tramways de Taschkent, which is at present electrifying its lines, is in negotiation with the municipal authorities at Taschkent in regard to a concession for the supply of electrical energy for public and private electric lighting and power purposes in the town.

Italy.—A decree ratifying the concession has been granted to the Società Tramviaria Valenzana for the construction and working of an electric tramway from Valenza Railway Station to the town of the same name.—*Board of Trade Journal.*

Spain.—The work of electrifying the horse tramway system in the town of La Coruna has lately been completed. The contract was carried through by the Sociedad Siemens-Schuckert Industria Electrica, the plant being constructed in the company's works at Cornella, Barcelona. The necessary current is supplied from the generating station of the Sociedad Electra Industria Corunesa.

Germany.—The plans for a tramway tunnel under the Rhine, connecting Düsseldorf with Obercassel, have now assumed definite shape. The tunnel will be driven below the Rhine Bridge, and in the middle of the river will sink 7·30 metres under the river bed. On the Düsseldorf side an entrance 17 metres deep is arranged for. On the Obercassel side an entrance 6 metres deep is to be made. The tunnel will be drained from a sump in the deepest part by electrically-driven pumps, and ventilated by electric fans. It will be lit by electric lamps disposed so as to facilitate safe

working. Only the tramways will use the tunnel, other kinds of traffic being relegated to the Rhine Bridge. The cost of the undertaking is put at £212,500.—*Zeit. fur Elektrotechnik und Maschinenbau.*

Edinburgh.—On November 26th the Tramways Committee decided to obtain tenders for six motor-'buses to run on the south side route, and to negotiate with the Tramway Co. with a view to an agreement for the running of the motor-'buses.

At the meeting of the Tramways Committee last week, a proposal, recommending the Corporation to promote a prov. order for the construction of a tramway from the existing car terminus in Corstorphine Road to the village of Corstorphine was remitted to the burgh engineer.

London.—ELECTRIC AMBULANCES.—Of the £18,680 proposed to be spent by the Metropolitan Asylums Board on the institution of an ambulance service, £14,480 is to go towards the cost of purchasing 25 electrically-driven ambulances and the apparatus for 18 charging depôts.

Morley.—RAILLESS TRACTION SCHEME.—It is anticipated that the construction of the overhead equipment for the railless traction system, powers for which were recently obtained, will be commenced at an early date by the Corporation. The route commences at the Leeds terminus of the railless system at Farnley, and runs to the Bradford terminus at Drighlington, and thence to the borough boundary at Tingley Common. From this point Ardsley East and West U.D.C. will carry the system to the Bay Horse Inn, East Ardsley. The Leeds Corporation will undertake the running powers and supply the cars for a term of years.

Newcastle-on-Tyne.—A TRAMWAYS REPORT.—Ald. J. H. Rodgers, speaking at the annual meeting of the Tramways Committee of the Corporation on November 27th, at which he was re-elected chairman, said that although there was a large increase in the volume of traffic during the half-year ended September 30th, the net profit was less. There was an increased income of £11,950, but an increased outlay of £11,970. There was a net surplus of £11,435, which was £1,200 less than in the corresponding half-year. Now that the system was getting older, the repairs were getting heavier, and coal had almost doubled in price. During the half-year they had spent £21,000 out of the reserve fund. This work would continue to go on each half-year, and the possibility was that during the next six months there would be anything from £10,000 to £20,000 spent out of the reserve fund, and it would be necessary to build up that fund again to the extent to which they had depleted it. Whilst the tramways were perfectly safe conducted as they had been during the past few years, they could not continue to grant concessions, spending money as they had been doing in the last six months. In the future the cost of maintenance would increase, and they could not expect good times and good trade to continue for ever, and if they continued to build up, as they unfortunately had been doing, permanently increased charges, they would find they could not curtail those expenses when they came to bad times.

New Zealand.—The report of the manager of the Dunedin Tramways on the question of a suitable type of omnibus for a service to be run in conjunction with the ordinary tramway service, recommends the adoption of the petrol-electric vehicle.—*Board of Trade Journal.*

Northampton.—PLANT EXTENSIONS.—The engineer has been instructed to submit a competitive tender for the work of constructing the tramways to Far Cotton. The Tramways Committee reported that in consequence of the increase of traffic and the necessity for an increased service, it had obtained estimates for the following plant, and proposed at once to enter into formal contracts for the purchase of the plant, at a cost not exceeding £10,850:—Engine and generator (400 to 450 KW.), £2,300; condenser, £1,250; battery (800 amps., one-hour rate), £2,100; switchboard extension (one panel), £100; steam pipe extension, £100; extension of car shed, £2,400; four new cars, £2,600.

Salford.—Subject to the confirmation of the Council, the Tramways Committee proposes early in the New Year to make various reductions of fares and to extend many stages. The scheme is estimated to cost £5,000 per annum, but the Committee hopes that an increase of passengers will help to make up for this diminution in the amount available for the relief of rates.

Sheffield.—The tramways department is experimenting with a device for showing the number of passengers seated on the top of a car.

Sunderland.—IMPROVED TRAFFIC RECEIPTS.—At the annual meeting of the Tramways Committee, last week, the chairman stated that the traffic receipts up to the present were £5,000 in advance of those for the corresponding period last year, and £800 better than the takings in any previous year for a similar period.

Tunis.—An agreement has been entered into between the Director of Public Works and the President of the Tunisian Tramways Co., whereby the latter is empowered to construct an electric railway from Tunis to Hammam-Lif, *via* Djebel-Djelloud, Mégrine, Radès and St. Germain.—*Board of Trade Journal.*

U.S.A.—The City Council of Chicago has asked for bids on the construction of a system of comprehensive passenger railway subways. The Board of Harbour and Subway Commissioners has estimated the cost at about $130,000,000. According to the present plan, bids are to be received until January 5th, 1914, and then opened publicly. The comprehensive plan of subway construction, the Arnold plan of limited subway construction, and possibly others, will probably be submitted to the voters at the election in April, so that they may indicate their preference.—*Electrical World.*

TELEGRAPH and TELEPHONE NOTES.

Austria.—According to the Vienna *Elektrotechniker*, the negotiations for the organising of a great telephone-building programme against yearly annual payments by the Government (alluded to in our last issue), have made further progress lately, but the definitive settlement cannot be exactly foretold. Action in this matter started with the Siemens-Schuckert Werke, the firm of Felten und Guilleaume and the collective telephone and cable firms. Altogether, within three years, telephone installations to an amount of £2,500,000 will be carried out, while the doubling of this amount is in prospect. The manufacturers will hand over their claims on the State in their entirety to their bank connections, and the latter will make advances to the manufacturers on the strength of the yearly payments the Government will make. Under certain circumstances the banks may convert their claims on the State into the form of securities, the issue of which, however, cannot take place in the near future, owing to the unfavourable condition of the investment market.

Germany.—The four German telegraph bureaus—Louis Hirsch's Telegraphisches Bureau, Herold's Depeschen Bureau Gesellschaft m.b.H., Presscentrale Gesellschaft m.b.H., and the Deutsche Telegraph Gesellschaft m.b.H. have amalgamated, and become the Telegraphen Union. The object of the amalgamation is stated to be to extend and improve the International news service by the unification of the sources of news and of the numerous staffs of collaborators. The well-known German statesman, Von Podbrelski, is the president of the combined concern.—*Telegraphen und Fernsprech Technik.*

An underground telephone line has recently been completed between Berlin and Magdeburg. One is also being laid between the German capital and Hamburg.

Long-Range Wireless.—A message sent from Port Darwin, in Northern Australia, has been received and read distinctly at Lake Huron, Canada. The total distance is 9,000 miles, of which 3,000 are over land. No doubt this feat was merely a freak, caused by some unusually favourable condition of the atmosphere.

U.S.A. High-Frequency Patents.—Judge Rellstab, on November 17th, issued an order enjoining the Marconi Wireless Telegraph Co. of America against further infringement of the Fessenden high-frequency patents, but permitting the company to deliver apparatus to the United States Navy on giving suitable bonds, pending an appeal from the injunction. The Fessenden patents are owned by the National Electric Signalling Co.—*Electrical World.*

Russia.—The steamship company, "Aktiebolaget Bore," of Abo, is contemplating the installation of wireless telegraphy on its vessels plying between Abo and Stockholm.—*Board of Trade Journal.*

Hull.—The Finance Committee has adopted the report of the Telephone Committee, recommending the acceptance of the Postmaster-General's offer to sell the plant of the National Telephone Co. to the Corporation for £192,423.

Wireless in Fishing.—Wireless apparatus has been installed on several vessels engaged in fishing on the Dogger Bank, and is expected to prove of great service in guiding outward-bound vessels to the fleet, besides supplying the admiral of the fleet with information as to the state of the London market.

Dublin.—The hearing began in the Nisi Prius Court, Dublin, on Friday last, of an action by the Dublin County Council claiming a declaration that the Postmaster-General is bound to carry out an agreement entered into with the Council by the National Telephone Co. to supply telephone connections and apparatus to the offices of the Secretary of the Council, the County surveyor and the solicitor to the Council.

Postal Servants.—In spite of the concessions granted by the Postmaster-General, dissatisfaction is expressed by certain sections of the staff, and the possibility of a strike is being seriously considered. A conference of employés is to be held at Leicester to-morrow.

Swansea.—The Post Office Department proposes to construct a new central exchange, to complete the installation of underground cables, and to extend the latter to Llanelly, Neath, Port Talbot and Cardiff, at a cost of about £150,000.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—A new set of automatic signals for use on the Oswaldtwistle tram section is to be purchased.

The Electrical Engineer has been instructed to obtain provisional tenders for additional gas plant.

Argentina.—December 20th. The Municipality of La Paz, Entre Rios, is calling for tenders for installing electric light in that city. Specifications from the Municipality.—*Review of the River Plate.*

Ashton-under-Lyne.—December 19th. Motor for circular saw, and two press-button electric passenger lifts for the workhouse, Chamber Hills. Specifications, &c. (£2 2s.), from G. H. Partington, Clerk to B. of G., Poor Law Offices, Stamford Street.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

December 31st.—For the P.M.G. Insulators. See "Official Notices" October 31st.

Melbourne.—March 18th, 1914. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" November 28th.

Victorian Railways Department.—January 28th, 1914. One three-phase alternator &c.—*Tenders.*

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

December 22nd. Melbourne Suburban Railways. Copper track bonds and accessories. See "Official Notices" November 28th.

Brisbane.—January 7th, 1914. Switchboards, parts and accessories. Schedule No. 274. Telephone instruments, &c. Stores Schedule No. 275. Measuring instruments, &c. Stores Schedule No. 277. Telegraph instruments, &c. Stores Schedule No. 276. Protectors, parts, &c. Stores Schedule No. 278. See "Official Notices" to-day.

Belgium.—December 16th. The municipal authorities of Schaerbeek are inviting tenders for the supply of the electricity meters required in connection with the electricity supply undertaking. Copies of the specification can be obtained for 5d. from the Caisse Communale, 30, Rue de la Ruche, Schaerbeek, Brussels, while particulars can be secured from the Service de l'Electricité, at the same address.

December 20th.—The Belgian Post and Telegraph Authorities in Brussels (La Salle de la Madeleine) are inviting tenders for the supply and laying of a quantity of telephone cables in the Brussels district.

Bohemia.—Trubau.—December 15th. Supply of two electric running cranes, 25 and 3 tons lifting capacity respectively, for the boiler smithy at the railway works. Trübau. Particulars of the Abteilung IV/4, Fachabteilung für Zugförderungs und Werkstättendienst, 3, Schwarzenberg Platz, Vienna I (enclosing 1 krone).

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 kw.; storage batteries, boosters and switch and regulating gear; two 1,500-kw. rotary converters, transformers and switchgear. See "Official Notices" November 28th.

Canada.—Yorkton (Sask.).—December 22nd. Tenders marked "Tenders for Diesel Electric Machinery" to be addressed to T. F. Acheson, Secretary-Treasurer, Town of Yorkton, for one 500-B H.P. combined unit. Specifications, &c., from M. M. Inglis, electrical engineer, Yorkton.—*Canadian Engineer.*

According to an announcement in the *Canadian Engineer*, the Bowness Improvement Co., 202, Eighth Avenue West, Calgary, Alta., is inviting tenders, until December 31st, for a 200-kw. traction motor generator, a four-panel switchboard, a 250-k.v.a. generator, and a vertical single-acting multi-cylinder gas engine. Specifications from Mr. T. L. Turnbull, consulting engineer at the above address. The date for sending in tenders for transforming machinery "to convert hydro-power into direct current" for the street railway, is extended from December 15th to February 15th.

Colchester.—December 9th. Electrical sundries for six months for County Asylum, Severalls. Mr. R. Overend, Clerk, the Asylum.

Darwen.—Tenders are to be invited for the supply of wind screens on tramcars.

Edinburgh.—The T.C. Tramways Committee is to invite tenders for six motor-'buses to run on the south side route.

France.—December 13th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of six lots of telephone exchange switchboards.

The Administration des Chemins de Fer de l'Etat is about to purchase:—Lot 5, electrical material needed for the local lighting and power sub-station at the Argenteuil-Triage railway station. Lot 6, 12 electric travelling lifts for the erection shop at Batignolles. Particulars, 43, Rue de Rome, Paris.

Leigh (Lancs.)—December 19th. Corporation. Water-tube boiler, with mechanical stoker, forced draught plant, air heater, &c. See "Official Notices" to-day.

London.—L.C.C.—December 10th. Installation, 265 lighting points, at Ocean Street Elementary School, Mile End, E. See "Official Notices" November 28th.

L.C.C. Fire Brigade Committee.—Installation of the electric light in the Cherry Garden Street Fire Station and the supply of electric charging apparatus for installation at Clapham, Dulwich, Hackney, Holloway, Kensington, Lee Green, and Streatham fire stations.

December 9th. Ten tons cotton-covered copper wire for the Tramways Department. Also trolley wire. See "Official Notices" to-day.

December 23rd. Steam, exhaust, condenser, feed, &c., piping, water tanks, &c., for Greenwich generating station. See "Official Notices" to-day.

Royal Mint.—December 15th. 100 tons of copper in ingots. See "Official Notices" to day.

Shoreditch.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" November 21st.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Manchester.—December 19th. Corporation. Motor-converters or rotary converters and static transformers as follow:—Four 1,000/1,250-kw. sets; one 1,000-kw. set; and two 650/800-kw. sets. See "Official Notices" to-day.

New Zealand.—February 19th. The Christchurch City Council invites tenders for (1) underground and aerial cables; (2) testing instruments; (3) underground troughing and covering; (4) transformers; (5) meters and demand indicators; (6) marline, tape and rubber mats; (7) enamelled iron tablets; (8) insulators; (9) service fuse boxes. Specifications 10s. each, or £3 for complete set of nine.—*New Zealand Shipping and Commerce.*

Christchurch.—December 24th. Cable, testing instruments, transformers, meters, insulators, &c., for the City Council. High Commissioner for New Zealand in London.

Portugal.—December 12th. The municipal authorities of Serpa are inviting tenders for the establishment of a central station for the supply of electrical energy for public and private lighting and power purposes in the town.

Ramsbottom.—The U.D.C. has decided, in connection with the railless trolley system, to purchase two new cars, in which many improvements will be embodied.

South Shields.—December 13th. Corporation. Two water-tube boilers, with mountings and fittings, &c.; one economiser. See "Official Notices" November 28th.

Spain.—December 15th. Tenders are being invited by the municipal authorities of Belmez for the establishment of a central station in the town capable of supplying current for 2,000 10-c.p. metal filament lamps.

Stockton.—December 22nd. Construction of Stockton to Billingham Beck Branch Railway (about three miles in length), for the N.E. Railway Co. Mr. C. F. Bengough, Company's Engineer, York.

Sweden.—Stockholm.—Five sluice gates for tube inlet, also accessories. Weight of gates, about 85 tons. For Porjus Power Station.

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

Wolverhampton.—December 16th. Supply and laying of cables, re-wiring lamp standards, &c., Heath Town Workhouse, for the B. of G. Mr. F. Harrison, Clerk.

Worksop.—December 15th. Electric light installation (123 lamps) for the B. of G. Mr. J. S. Whall, Clerk, 66, Bridge Street.

York.—Electricity and Tramways Committee. Tenders for the trucks, car bodies, and gear for four trailers.

December 22nd.—Corporation. Stores for electricity and tramways department. See "Official Notices" to-day.

CLOSED.

Accrington.—The Electricity Committee has recommended the acceptance of a tender by Leyland Motors, Ltd., for a 30-H.P. motor tower wagon costing £610.

Bacup.—The Electricity and Tramways Committee has ordered 12 three-ampere meters from the B.I. and Helsby Cables, Ltd.

Bedford.—The B.C. Electricity Committee recently invited tenders for (1) mixed pressure turbine, alternator, exciter, air filter and condensing plant; (2) water-tube boiler, mechanical stoker and coal-handling plant. Twenty tenders had been received for No. 1, and two for No. 2. These had been referred to a sub-Committee.

Bexhill-on-Sea.—The T.C. has accepted the tender of Messrs. Pettit & Co. for 30 tons of Kent coal, at 19s. per ton, for the electricity works.

Australia. — COMMONWEALTH. — P.M.G.'s Department :—

20 relay keys, £565.—Maritime Wireless Co.

The following contracts have been accepted by the Commonwealth :—

MELBOURNE.—

25 cable distributing boxes, five pairs, £12 : 50 ditto, 10 pairs, £31 ; 50 ditto, 31 pairs, £36 ; 25 ditto, 52 pairs, £47.—W. T. Henley's Telegraph Works Co., Ltd.

50 miles tinned rubber-insulated cotton-covered and braided copper wire, £172 ; 60 miles ditto, £177 ; 150 miles twisted pair, tinned annealed copper, vulcanised rubber-insulated, taped and braided, £4,062.—Armorduct Manufacturing Co., Ltd.

20,000 zincs, Leclanché, £149.—Lawrence & Hanson Electrical Co., Ltd.

800 steel battery brushes, £34 ; 750 coppers, £31 ; 10,000 zincs, Meidinger, £307 800 zincs, for gravity cells, £575.—I.R., G.P. and Telegraph Works Co., Ltd.

1,500 G.I. suspended strand clamps, £112.—Western Electric Co. (Aus.), Ltd.

SYDNEY.—

12 miles switchboard cable, £89 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

4 miles switchboard cable, £124 per mile.—B.I. & Helsby Cables, Ltd.

2 miles switchboard cable, 21 conductors, £42 10s per mile ; 14 miles ditto, 10½ conductors, £224 per mile.—Australian Metal Co.

—*Australasian Record.*

Messrs. Pope's Electric Lamp Co., Ltd., have received a further contract from the Melbourne City Council for 33,300 lamps.

N.S.W.—P.M.G.'s Department :—

440 lodge arresters, 17s. 6d each.—E. H. Kirkby.

Telephone material.—J. Bartram & Son Pty., Ltd.

15 miles paper-insulated, lead-covered cable, 416 pairs, 19½ lb., conductors not served, £1,100 per mile : 15 miles ditto, 26 pairs, conductors served, £166 per mile.—B.I. and Helsby Cables, Ltd.

—*Tenders.*

The Cock's Pioneer Sluicing Co., Eldorado, Vic., has placed an order with the Australian Metal Co. for the supply of a complete power house equipment.—*Tenders.*

The *Australian Mining Standard* for October 23rd says :—"When in London at the beginning of the year, Mr. Scaddan, Premier of Western Australia, arranged for a power house and plant for the Perth trams and lighting, and for the electrification of some of the railway sections. Four contracts have been let for a total of £188,521 with Babcock & Wilcox, Willans & Robinson and the British Westinghouse Co., and tenders have been called in London for three others, estimated at about £85,000. All works are to be completed by June, 1914. Last week an agreement was signed by the Premier and the Mayor of Perth respecting the lighting of the city. The engineer-in-chief, Mr Thomson, now in England, is reporting on the railways electrification scheme."

SHIRE OF NUNAWADING.—Aluminium cable, £1,420, B.I. and Helsby Cables, Ltd.—*Australian Mining Standard.*

Bolton.—The Corporation has accepted the following tenders in connection with the new generating station at Back-o'-th'-Bank :—

Erection of staircases and ladders.—Messrs. Grimshaw & Peers.

Iron fences.—Bolton Moor Foundry Co., Ltd.

Bury.—Electrical blowing apparatus for the Bank Street Chapel organ, Mr. Clarence A. Cass, Bury.

Canada.—WINNIPEG.—Contract has been awarded the Inperial Wire and Cable Co. for 5,500 ft. of 2,200-volt, three-core, paper-insulated, lead-covered cable.

HANLEY, SASK.—A contract has been awarded to the British Canadian Engineer and Supply Co. for a producer gas electric plant. —*Canadian Electrical News.*

HAMILTON, ONT.—The contract has been awarded the Hamilton Standard Underground Cable Co. for the cable on the hydro system, at a cost of $53,675.

TORONTO, ONT.—The Abitibi Pulp and Paper Co. has placed an order with the Canadian Allis-Chalmers Co., Ltd., for a number of high-lift turbine pumps and centrifugal pumps all driven by Canadian General Electric motors.—*Canadian Engineer.*

Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for marine traction type tantalum lamps from the Canadian Northern Railway system, for use on their Atlantic Steamship service vessels.

Dartford.—The following tenders have been provisionally accepted by the U.D.C. for new plant :—

Babcock & Wilcox, Ltd., water-tube boilers, steel chimney, foundations, piping and accessories, £4,845.

Johnson & Phillips, Ltd., rotary converters, switchboard, cabling and accessories, £4,321.

B.I. and Helsby Cables, Ltd., £550 (estimated).

Darwen.—The Council has accepted the tender of Messrs. H. Baldwin & Co. for the supply of coal to the electricity works.

Eccles.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., to supply consumers' electricity meters for 12 months.

Liverpool.—The City Council has accepted the tenders of W. A. Stevens, Ltd., the Brush Electrical Engineering Co., Ltd., and Straker & Squire, Ltd., for the supply of two motor-'buses each.

Grimsby.—The Education Committee has appointed Messrs J. D. Beckett & Co. as the electricians for districts Nos. 1 and 2 for the year ending December 31st, 1914.

The Public Lighting Committee has recommended the following tenders for acceptance to the Town Council :—

W. Lucy & Co., Ltd.—House service boxes, £171 ; fittings, £49 ; house fuse boxes, £158.

Crysalco, Ltd.—Metal-filament lamps, 75, 65, 50, 32 and 25 C.P., £46. The same firm has held the contract for the last four years. The majority of the lamps used will be of 65-C.P. size.

W. Browne & Co., Grimsby.—Coal, 7s. 8d. per ton, for three months.

London.—SHOREDITCH.—The following tenders have been received for the supply of lead-covered paper-insulated cable for house services for six months :—

		·0224.	·035.	·095.	
Siemens Bros. & Co., Ltd.	(accepted)	£72 0	£91 0	£187	per mile.
W. T. Glover & Co.		73 10	92 10	190	,,
Western Electric Co., Ltd.		73 15	94 0	192	,,
W. T. Henley's Telegraph Works, Ltd.		74 0	93 0	191	,,
Helsby Cables, Ltd.		74 0	93 0	192	,,

Approximate quantity, three miles, ·0224 ; two miles, ·035 ; one mile, ·095.

L.C.C.—For the supply of electric cables, wires and flexible cords (Schedule No. 16), for 12 months from January 1st, 1914, the following have been accepted by the Stores and Contracts Committee :—Connolly Bros., Ltd., item 4 (*a*) and (*b*) ; W. T. Henley's Telegraph Works, Ltd., item 1 ; Hooper's Telegraph and India-Rubber Works, Ltd., items 2, 3, 6, 7 and 8 ; the Liverpool Electric Cable Co., item 5.

For electrical wiring and apparatus (excluding generating plant) at Maudsley Hospital, the following tenders have been received :—

Tyler & Freeman	(accepted) £1,485	Edmundson's Electricity Corporation, Ltd...	£1,705
G. E. Taylor & Co.	1,500	Donneson, Sillem & Co. ..	1 849
H. J. Cash & Co.	1,599	Foote & Milne	2 049
Drake & Gorham	1,640	Strode & Co.	2,117
Tredegar & Co.	1,640		
T. Clarke & Co.	1,704		

The Highways Committee recommends the acceptance of the tender of Rowley Bros. for the erection of the completion of Abbey Wood car shed, at £16,981.

The following tenders have been received for the supply of—(A) of 1 ton of T.C.C. copper wire, ·229 in. diam., and (B) 1½ tons of D.C.C. copper wire, ·229 in. × ·229 in., in connection with winding car field coils :—

	A.	B.	Discount.
Siemens Bros. & Co.	£96 5 0	£80 6 8	—
B.I. & Helsby Cables .. (accepted)	93 6 8	91 0 0	2½
Midland Electric Wire Co., Ltd ..	93 6 8	93 6 8	2½
London Electric Wire Co. & Smiths ..	91 0 0	93 6 8	2½
I.R., G.P. and Tel. Works	99 17 6	100 17 6	2½
Johnson & Phillips	98 0 0	101 0 0	—
Henley's Telegraph Works Co. ..	105 0 0	101 10 0	2½
General Electric Co.	105 0 0	102 18 4	2½
Callender's Cable and Con. Co. ..	110 0 0	112 0 0	2½
Western Electric Co.	110 0 0	112 0 0	2½

Luton.—The following tenders have been accepted by the T.C. for the Electricity Department :—

E. Green & Son, Ltd., economiser and damper, £837.

Sturtevant Engineering Co., Ltd., air filter for turbines, £245.

W. H. Bowater, Ltd., annual supply of Ibstock coal, 13s. 9d. per ton.

Maidenhead.—The T.C. has accepted the tender of the Diesel Engine Co., Ltd., for a pump for the Electricity Works, at £29.

Plymouth.—The Electricity and Street Lighting Committee held a special meeting on Tuesday, at which 11 tenders were received for switchboard panels in connection with the electricity works extension. The lowest tender, that of Messrs. Johnson & Phillips, Ltd., at £581, was conditionally accepted.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for welding about 600 tramway rail joints, at 30s. per joint.

Southampton.—The T.C. is to purchase from Pirelli, Ltd., the necessary quantity of cable required to supply the firm's works with energy. The approximate length required will be 600 yards, for which Messrs. Pirelli quoted £1,203 per mile for 1-in. cable, and £659 per mile for ½-in. cable.

Warrington.—The Electricity and Tramways Committee has accepted the following tenders for extensions at the electricity works :—

Boiler plant.—Babcock & Wilcox, Ltd., £2,362.

Turbo alternator plant.—J. Howden & Co., Ltd., £5,843.

Condenser plant.—Worthington Pump Co., Ltd., £3,344.

Economiser plant.—Goodbrand & Co., Ltd., £203.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, December 8th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, December 9th.—"B" Company. Ditto.

Wednesday, December 10th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, December 11th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, December 12th.—"D" Company. Special class on Crossley engine, 7 p.m. Technical instruction, 7.30 to 9.30 p.m.

Saturday, December 13th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

, 1918.

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HIGH-SPEED TURBINES AT MARYLEBONE.

Through the courtesy of Mr. A. H. Seabrook, the manager of the Marylebone Council's electrical undertaking, we are able to illustrate and briefly describe the new high-speed turbine plant which has recently been brought into use at the Council's generating station.

It may be remembered that this station was equipped throughout in the first instance with Parsons direct-current turbo-generating plant which was, in fact, amongst the most modern and efficient plant available at that time.

A comparison between these 8-year old machines and the small and highly efficient turbo-alternators which have been installed, shows the unmistakable progress which the turbine builder has made during that period, and which is no less noteworthy than that shown when turbine machinery first supplanted reciprocating plant on a commercial scale.

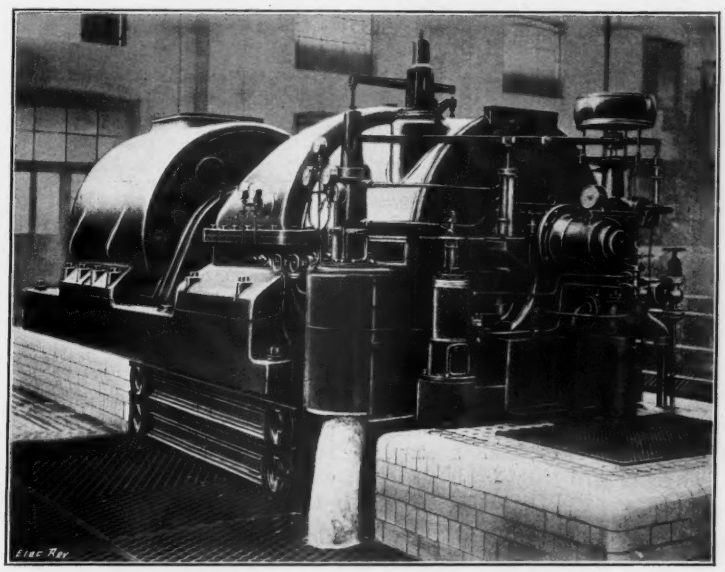


Fig. 1.—View of the Steam End, 3,000-4,200-kw. Oerlikon Turbine Set.

The new generating plant was supplied by the Maschinenfabrik Oerlikon, and consists of two sets, each consisting of a pure impulse type turbine coupled to a totally-enclosed three-phase alternator, generating current at 6,600 volts pressure and 50 cycles; an extension of the main-shaft carries the exciter, and the sets run at a speed of 3,000 r.p.m., each giving a normal output of 3,000 kw., and on a six-hour rating, 4,000 kw. We believe these are the first 3,000 r.p.m. turbine sets of this size to be brought into use in this country, and whatever may be the advantages of lower speeds, the low first cost, small space taken up, and high efficiency secured in the new Marylebone plant, are factors which cannot be ignored in connection with the general cheapening of electricity supply.

The new sets run on 190-lb. steam pressure, and 100° of superheat, and although greater pressure and superheat were desirable, the steam consumption on full load is guaranteed at 13·27 lb. per kw.-hour, and appears likely in practice to be 4 per cent. better; on $\frac{3}{4}$ load the consumption is 13·73 lb.

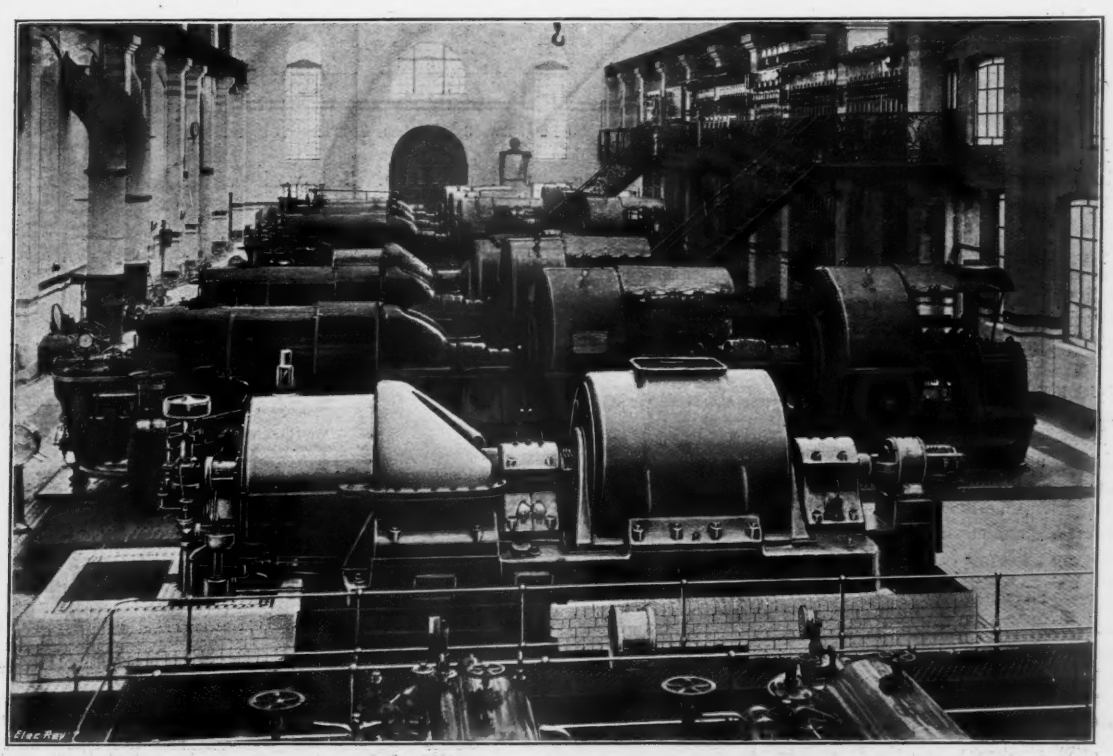


Fig. 2.—General View of the Marylebone Generating Station, showing a 3,000-4,200-kw. a.c. Turbine Set in the Foreground and the older 2,000-kw. d.c. Turbine Sets behind.

Fig. 2 shows one of the new sets in the foreground, with the older 2,000-kw. turbine units behind, and incidentally gives a good idea of the small space occupied by

the new plant as compared with the old; fig. 1 shows the steam end and governor gear of the same set, the governing being electrically controllable from the switchboard.

The turbine sets are being erected complete with Worthington condensing plants, each including a surface condenser of 10,500 sq. ft. cooling area to deal with 52,500 lb. steam per hour, coupled to the turbine above through a 52-in. diameter gate valve; a 22-in. motor-driven centrifugal circulating pump and electrically-driven three-throw air-pump. The first of the new turbines has been temporarily coupled to two old condensers which served four 500-KW. turbine sets, and due to the small steam consumption of the new plant, the latter has carried 3,800 KW. under these conditions.

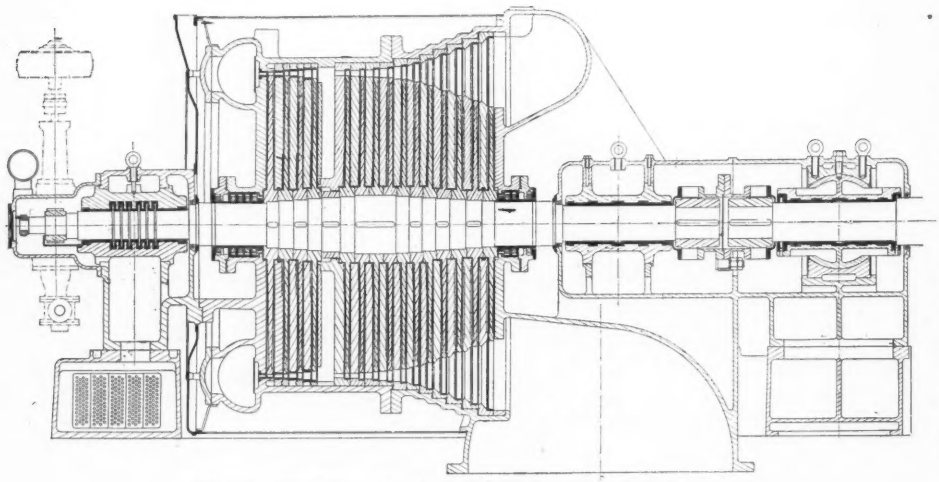


FIG. 3.—SECTIONAL VIEW, OERLIKON IMPULSE TURBINE.

Both the machines are arranged for forced ventilation, and the air is supplied from a Sturtevant wet-air filter plant, situated outside the engine room and shown in fig. 7; the air is passed into the cable race under the engine room—which it incidentally ventilates—then through ducts to the alternators, being discharged into the engine room.

Our illustration shows the comparatively small size of this wet-air plant which will deal with 8,000 KW. The new H.T. switchgear, supplied by Messrs. Ferranti, containing the control panels for the new machines and for the trunk feeders to Manchester Square and Rathbone Place sub-stations, and for a 1,000-KW. rotary converter installed in the generating station, has been erected on the main switch-gallery at one end of the direct-current switchboard.

Until recently the switchgear at this station was arranged on two galleries, one across each end of the generating station, which was originally illustrated and described in the ELECTRICAL REVIEW, Jan. 18th, 1907; in view of the growing output of the station, it was decided to rearrange and modernise the control of the plant, and with this object in view the old direct-current panels have been re-erected on the gallery shown in fig. 5, running down one side of the engine-room. This work was carried out between June and September last, and as now erected the field control of the machines with the necessary machine and pilot instruments are gathered together on the centre panels, with the

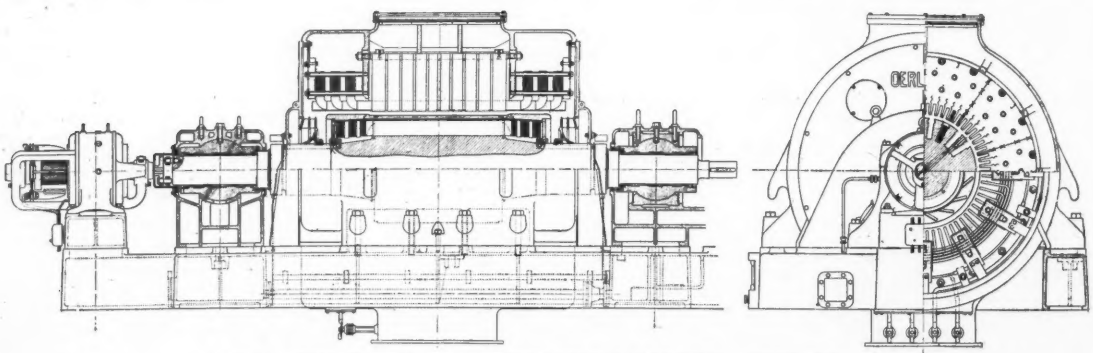


FIG. 4.—SECTION OF OERLIKON 3,000-4,200-KW. 3,000-R P.M. ALTERNATOR, &C.

FIG. 5.—NEW SWITCH GALLERY, MARYLEBONE GENERATING STATION; NEW H.T. SWITCHGEAR ON THE LEFT.

positive panels on the right, and the negative panels on the left, the new H.T. control panels being on the extreme left.

The whole of the field rheostats for the direct-current plant are installed in a centre chamber immediately behind the controlling panels; the feeder fuses which were originally under the switch galleries, are now fixed to brickwork partitions several feet behind their respective panels, while the H.T. oil switches and bus-bars are enclosed in brick cubicles, also some distance behind the control panels, to which they are connected by mechanical control.

Three H.T. trunk cables, supplied by the B.I. and Helsby Co., run to the Manchester Square sub-station, terminating in a special selector panel, which enables either of them to supply locally through two 1,000-KW. rotary converters, or to be connected to two further feeders which run to the Rathbone Place sub-station, where also a 1,000-KW. rotary has been installed for the supply of the local network.

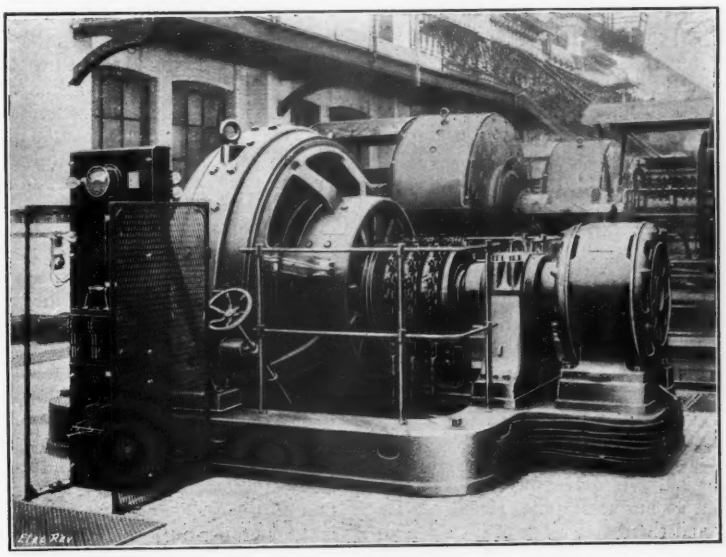


FIG. 6.—1,000-KW. WESTINGHOUSE SELF-SYNCHRONISING ROTARY, MARYLEBONE.

These rotaries are identical with that installed in the generating station and illustrated in fig. 6, and were supplied by the Westinghouse Co.

Each of them is provided with the Rosenberg self-synchronising apparatus and an alternating-current booster, the latter, on account of the wide variation in pressure, between 490 and 560 volts, required for the direct-current distribution.

We understand that the capital cost of the new H.T. scheme amounted to £42,000, and that, after allowing 10 per cent. per annum on this expenditure, direct current can be delivered to the sub-stations at about ·3d. per KW.-hour, at a 20 per cent. load factor. In effect, the saving arising from decreased steam consumption—the new plant requiring, roughly, 13 lb., as against 17 lb. per KW.-hour on full load with the old plant—amounts to more than the capital charges on the new plant, so that the department obtains the use of 6,000 to 8,000 KW. additional plant capacity at no cost.

It may be mentioned that various improvements have been effected in the boiler house, where originally each pair of Babcock boilers was provided with an independently-fired superheater.

In view of the additional space set at liberty, and the saving in running and maintenance cost, the independent superheaters with their machine stokers have given place to integral superheaters in each boiler, with, however, a modification in design, which provides for a connection to and from the superheater of the same size as the boiler stop valve, and a butterfly valve, by means of which the proportions of superheated and saturated steam passing to the top valve can be varied at will. The arrangement is found to give excellent control of the superheat.

The Marylebone boiler plant operates under induced draught, and as the boilers are not working at their full power, it will be possible by increasing the fan draught to obtain from 20 to 25 per cent. additional steam from them. This steam reserve and the low average steam consumption and compactness of modern turbine plant which may be installed, are such that the existing generating station will probably serve the Council's purpose for some years to come, despite the noteworthy increase in the sales of energy which is taking place in the area, and which, it is satisfactory to note, shows no signs of abatement.

FIG. 7.—STURTEVANT WET AIR FILTER.

FIG. 8.—NEW STREET LIGHTING, MARYLEBONE.

Street Lighting.—An interesting departure in street lighting has been made at the new Baker Street Circus, by Baker Street Station, where four 5-lamp columns on the American ornamental street lighting system have been erected, each containing a total of 600 watts, made up of one 200 and

four 100-watt lamps. The fittings, fig. 8, were supplied by Mr. Haydn Harrison ; the columns are the standard Metropolitan Board of Works type, slightly extended ; the globes are Alba and Superlux and the lamps Osram and Mazda. On the refuge and sidewalk are 3-lamp fittings, 400 watts per post.

It is contended that this method of street lighting gives a most pleasing effect, and even if wasteful in current the effect is of more importance from an advertising point of view than a correct system of illumination, which may possibly not be pleasing in appearance. The posts previously erected on this site were two-light 160-watt, and three-light refuge-type of 240-watt capacity, for which £4 9s. 6d. and £6 14s. 6d. per post per annum, respectively, were charged.

The charge for the new 600-watt posts is £14, and for the 400-watt posts £10, per post per annum, so that over three times the light is being given for, approximately, twice the money. The final globes are not yet decided upon ; when this is done, all the posts will be of 600-watt capacity.

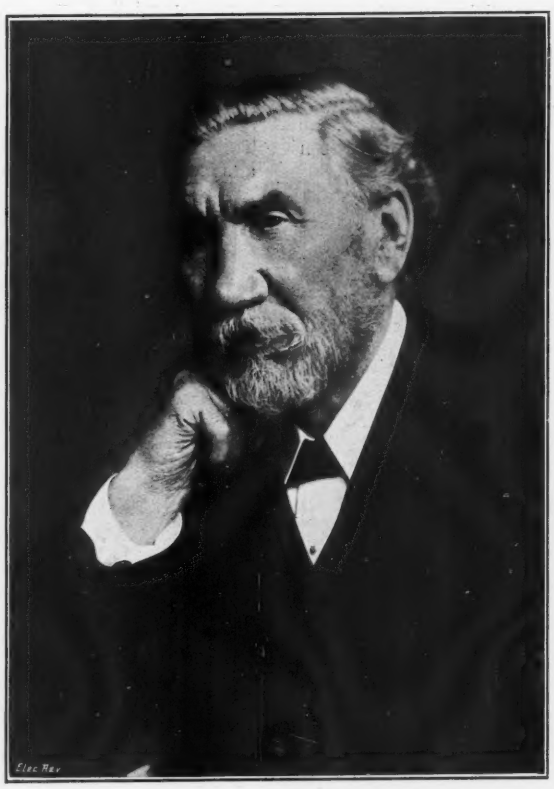
In conclusion, we are indebted to Mr. Seabrook and to his station engineer, Mr. Richardson, for their assistance in connection with the above article.

MR. JAMES HOWDEN.

As briefly stated in our last issue, Mr. James Howden, chairman of the firm of James Howden & Co., Ltd., engineers and boilers makers, Glasgow, passed away on November 21st, in his 82nd year. He was ill for only a short time, having been at business quite recently. He underwent an operation, and there were signs of his splendid constitution enabling him to make a good recovery notwithstanding his advanced age. A relapse came quite unexpectedly, however, to which he succumbed. Mr. Howden was born at Prestonpans and he went to Glasgow as a youth, beginning his career as an apprentice in 1847 with Messrs. James Gray & Co., makers of factory and blowing engines. Later, after a brief period in the offices of a Glasgow civil engineering firm, he took an appointment with Mr. Robt. Griffiths, where his work in connection with screw propellers laid the foundation for his subsequent chief engineering interest. He began business on his own account when only 22 years of age, designing rivet-making machinery, in which department he took out the first of a series of patents which ranged over the whole field of engineering, boiler-making and kindred subjects. He took his first contract for marine engines in 1859, putting in compound engines and water-tube boilers of his own design, using steam at 100 lb. pressure, a very decided advance in those days of single-cylinder engines using steam at from 20 to 25 lb. pressure. In 1862 Mr. Howden purchased ground in Scotland Street, and founded the firm of James Howden & Co., which prospered, necessitating larger works nine years later, and from that date onward he constructed engines and boilers for many leading steamship lines. In this connection the firm built up a world-wide reputation, but it is by reason of his system of hot-air forced draught that his name is best known. Early in 1882 he began a long series of experiments which eventuated in that system.

In a very few years the volume of business made it necessary for Mr. Howden to devote all his energies to the development of the forced-draught business, and to discontinue the manufacture of marine engines. This course was fully justified by the results, and in 1898 the business had increased to such an extent that extension was again necessary, and more land was acquired in the same street and new works were erected.

In 1900 he turned his attention to a special design of high-speed engine of the forced lubrication type, for driving electric generators. This engine embodies the accumulated experience of his earlier years, and is based on practically the same design as the marine engines built by him, one of the leading features being the method of conveying the steam from one cylinder to another without using outside pipes. The same success attended the production of these engines as had characterised his activities in the marine engineering world, large numbers of this type of engine in single units up to 2,000 H.P. having been constructed for installations at home and abroad, the principal clients being municipalities, colliery, factory and mill-owners, and steamship companies. Shortly thereafter Mr. Howden recognised that the steam turbine for electrical purposes would soon take the principal place for high powers, and would afford him a congenial field for his energies. He therefore commenced the manufacture of the Howden-Zoelly impulse steam turbine. This also has proved a great success, the company having supplied a large number to many of the leading city corporations and other power-users. It is interesting to record that the company are at this moment completing the fourth turbine order for the Corporation of Manchester, the capacity of the unit being 30,000 H.P. The latest development of Mr. Howden's Co. is the building in Govan of new works as a branch establishment for the manufacture of a special patented type of combination sectional water-tube boiler designed to embody the benefits of the cylindrical boiler with the good points of the water-tube boiler, but without any of the disadvantages of the latter. These boilers have also been designed to permit of the Howden system of hot-air forced draught being employed in a convenient form. We understand that already evidence is abundant that the boiler will be largely adopted both for marine and land installations, many contracts having been obtained. Mr. Howden had had his nephew, Mr. J. Howden Hume, associated with him in the active management of the business for over a quarter of a century ; during the latter half of the time he was managing partner, becoming managing director on the formation of the company in 1907. Mr. Howden's son, Mr. William H. Howden, has also been a director of the company since 1907, taking special control of the high-speed engine and turbine works. Mr. Howden was the last survivor of the original membership of the Institution of Engineers and Shipbuilders in Scotland, which was founded in 1857. He was also a member of the Institution of Civil Engineers, and a member of the Institution of Naval Architects. He contributed to the *Proceedings* many papers on important engineering and shipbuilding subjects.



The late Mr. James Howden.

He was a member of the advisory council of the International Engineering Congress in connection with the World's Columbian Exposition held in Chicago in 1893, and he received a remarkable ovation on his appearance at that Congress to read his paper on "Forced Combustion in Steam Boilers" at the request of his friend the late Admiral Melville, Engineer-in-Chief of the United States Navy.

FORTHCOMING EVENTS.

Faraday House Old Students' Association.—Friday, December 5th. At 7.30 p.m. At Holborn Restaurant. Annual smoking concert.

Institution of Mechanical Engineers.—Friday, December 5th. At 8 p.m. At Storey's Gate, S.W. "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Junior Institution of Engineers.—Friday, December 5th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential Address, by Sir Boverton Redwood, Bart.

Manchester Association of Engineers.—Friday, December 5th. At Whitworth Institute, Whitworth Park. Conversazione.

Northampton Polytechnic Institute.—Friday, December 5th. At 7.30. At the Institute, St. John Street, E.C. Annual Presentation of Prizes and Certificates, by Mr. C. S. Cobb, Chairman of the L.C.C.
Saturday, December 6th. Conversazione.

Salford Technical and Engineering Association.—Saturday, December 6th. Visit to Salford Electricity Works. At 7 p.m. At Royal Technical Institute. Annual Meeting.

Institution of Post Office Electrical Engineers.—Monday, December 8th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Elimination of Waste in Telephone Plant and Operating," by Mr. B. O. Anson.

Institution of Electrical Engineers (Students' Section).—Monday, December 8th. At 7.0. At Trocadero. Annual Dinner.

Institute of Marine Engineers.—Monday, December 8th. At 8 p.m. Discussion on Fuel Test.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 8th. At 8 p.m. Paper on "Shipbuilding and Shipyard Practice," by Mr. W. J. Drummond.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, December 8th. At 7.30 p.m. At Armstrong College. Discussion on Dr. Klingenberg's Address.
Friday, December 12th. At 7 p.m. At Hugh Bell School, Middlesbrough. Discussion on Dr. Klingenberg's Address.

Royal Society of Arts.—Monday, December 8th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (II), on "The Measurement of Stresses in Materials and Structures."
December 10th. At 8 p.m. Paper on "Applications of Electricity to Agriculture and Life," by Mr. T. Thorne Baker.

Society of Engineers.—Monday, December 8th. At 7.30 p.m. At the offices, 17, Victoria Street, S.W. Annual general meeting.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, December 9th. At 8 p.m. At Princes Street Station Hotel, Edinburgh. Discussion on Dr. Klingenberg's Address.
Thursday, December 11th. At 6.30 p.m. At the Grosvenor, Gordon Street, Glasgow. Twelfth Annual Dinner.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, December 10th. At 7.15 p.m. At Philosophical Hall, Leeds. Paper on "The British Standard Specification for Consumers' Electric Supply Meters." By Mr. S. H. Holden.

Batti-Wallahs' Society.—Wednesday, December 10th. Informal Evening.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, December 10th. At 7.30. At the University, Edmund Street. Discussion on "The Rating of Electric Machinery," introduced by Mr. A. R. Everest.

Association of Engineers-in-Charge.—Wednesday, December 10th. At 8 p.m. At St. Bride Institute, Bride Lane, E.C. Paper on "Water Raising and Measuring," by Mr. W. H. Booth.

Electro-Harmonic Society.—Friday, December 12th. At Holborn Restaurant, smoking Concert.

Greenock Electrical Society.—Friday, December 12th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Primary Batteries," by Mr. A. Bucklitsch; "Secondary Batteries," by Mr. H. J. Roberts.

Junior Institution of Engineers.—Friday, December 12th. At 8 p.m. At 39, Victoria Street. Paper on "Efficiency of Production," by Mr. H. N. Munro.
Saturday, December 13th. At 7 p.m. Reception, Dance and Whist Drive, at Caxton Hall, Westminster.

Manchester Association of Engineers.—Saturday, December 13th. At Grand Hotel, Aytoun Street. Paper on "Commercial Motor Road Traffic," by Col. R. E. Crompton.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 13th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

NOTES.

Electric Blasting on the Rand.—The subject of electric blasting as a system for use in the Witwatersrand gold mines was exhaustively treated in a paper read at the monthly meeting of the Chemical, Metallurgical and Mining Society of South Africa. The authors of the paper were Messrs. William Cullen, Thomas Donaldson and W. Waters. The advantages claimed for electric blasting and the probable effects of the system were considered in detail under the headings:—Health conditions, safety, economy.

Under the first heading, the writers point out that electric blasting will remove the necessity for white miners and natives to rush around to light up at firing time, and then travel through dust and fume-laden drives, stopes, &c.; as, except in special circumstances, no charges should require to be exploded before all workers are out of the mine. The authors state that it must be better for a miner, when working in a shaft or winze, to be able to explode his charges from a place of safety than to be obliged to light up each individual shot and then either climb up ropes or ladders, or be hauled up by bucket or skip, with the ever-present risk that some mishap may occur to prevent his getting safely away before any explosions occur.

On the question of economy, which (the authors state) comes last in importance, and should also be considered as least, first considerations made it appear that blasting with electricity would prove more costly than with safety fuse. When "cuts" are fired with instantaneous electric detonators, all charges attain their maximum force at the same instant, and better results are consequently obtained, and the extra time afforded for actual work at the face would ensure greater footage being broken, and thus compensate for the higher cost of actual materials used.—*South African Mining Journal.*

Electricity Supply Rifle League.—The following are the results of the November matches:—Brompton (Beale, 97), 565, *v.* Poplar (Randall, 89), 526; Brompton (Mugford, Furneaux, 97), 573, *v.* Stepney (Heaveside, 93), 527; Central (Gaze, Rhodes, 98), 573, *v.* Poplar (Frost, Mogg, 93), 539; Central (Wells, 99) 561, *v.* Westminster (Litt, 99), 569; Hackney (Hilling, 97), 551, *v.* Westminster (Neville, 96), 550; Hackney (Turner, 98), 563, *v.* Shoreditch (Weekes, 97), 565); Ilford (R. Tuffnell, Wilde, 98), 574, *v.* St. James's (Cockburn, 97), 565; Ilford (R. Tuffnell, 98), 571, *v.* Shoreditch (Ridd, Thomas, 96), 565; St. James's (Cockburn, 97), 558, *v.* Stepney (Barber, 94), 557. The following are the positions to date:—

	Matches.					Scores.	
	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster ...	14	12	2	0	24	7,963	7,662
Ilford ...	14	11	3	0	22	7,903	7,643
Shoreditch ...	14	10	3	1	21	7,946	7,694
Central ...	14	10	3	1	21	7,900	7,670
Brompton ...	14	8	6	0	16	7,850	7,655
St. James' ...	14	6	8	0	12	7,597	7,744
Hackney ...	14	3	11	0	6	7,636	7,690
Stepney ...	14	2	12	0	4	7,523	7,643
Poplar ...	14	0	14	0	0	6,930	7,847

The Electric Vehicle Committee.—The second meeting of this Committee was held at the I.E.E. on November 14th. The members of the Committee are as follows:—

I.M.E.A. Members of the Committee.

R. A. Chattock, City Electrical Engineer, Birmingham, Chairman.

F. Ayton, Borough Electrical Engineer and Tramways Manager, Ipswich, Hon. Secretary.

A. C. Cramb, Borough Electrical Engineer, Croydon.

J. Christie, Borough Electrical Engineer, Brighton.

J. E. Edgcome, Borough Electrical Engineer, Kingston-on-Thames.

H. Faraday Proctor, City Electrical Engineer, Bristol, Hon. Secretary of the I.M.E.A.

A. H. Seabrook, General Manager, St. Marylebone Council Electric Supply Department.

Co-opted Members of the Committee.

F. E. Gripper (Edmundson's Electricity Corporation), representing the provincial electric supply companies.

E. S. Jacob (Tudor Accumulator Co.) and W. S. Naylor (Chloride Electrical Storage Co.), representing the Accumulator Section, B.E.A.M.A.

J. F. Monnot (representing Arrol-Johnston, Ltd.) and R. E. Mossay (Lloyd Electric Cars), representing makers of electric vehicles.

W. H. L. Watson (Edison Accumulators, Ltd.).

At the request of one of the principal power companies, an invitation to nominate a representative to the Committee has been sent to the Association of Electric Power Companies; a similar invitation was sent to the Electrical Contractors' Association, which has appointed Mr. W. R. Rawlings for this purpose. It was felt desirable to have on the Committee a representative of the manufacturers of electric motors as well as one for the manufacturers of switchgear. Accordingly, the B.E.A.M.A. have been asked to appoint a member for each of these sections of the industry. When all these additional members have been appointed, every section of the industry will be represented on the Committee, with the exception of the London Electric Supply Companies who have declined the invitation which was sent to them. Replies declining the invitation were also received from the Royal Automobile Club, and the Automobile Association and Motor Union. As representing the F.R.A.M. Co., Mr. Conway Jenkins has been elected to the Committee. The present members of the Committee will hold office until December 31st, 1914.

Two Sub-Committees have been appointed, viz., the Technical Sub-Committee and the Commercial Sub-Committee. To the first has been referred the matter of the adoption of a standard plug; this matter will be taken in hand as soon as the drawings of the revised standard plug in use in America come to hand from the Electric Vehicle Association, with which the Committee is now affiliated through the membership of its hon. secretary. The matter of obtaining specially favourable rates for the insurance of electric vehicles has been taken in hand, and it is probable that some definite decision will be come to by the companies within the next six months or so. The question of tariffs for charging vehicle batteries is being considered by the Commercial Sub-Committee, and it is proposed to arrange, if possible, a conference between the Committee and the representatives of the London Electric Supply Companies. The Commercial Sub-Committee is also taking up the matter of publicity work.

Anglo-American Exposition, 1914.—In connection with this Exhibition, which is to be held at Shepherd's Bush, London, from May to October next year, an Electrical Committee has been appointed as follows, those marked with an asterisk being members of the Executive :—

W. M. Mordey, *Chairman.**
R. Hammond, *Vice-Chairman.**
H. R. Kempe, *Hon. Secretary.**

A. S. E. Ackerman	Dr. S. D. de Ferranti	S. L. Pearce
P. R. Allen	E. Garcke	H. Faraday Proctor
S. W. Baynes	Leon Gaster*	W. R. Rawlings*
W. Worby Beaumont*	T. E. Gatehouse*	Alexander Russell
Major G. Harland Bowden*	Albert Gay*	Capt. H. R. Sankey
	F. Gill	A. Hugh Seabrook
H. R. J. Burstall	Haydn T. Harrison*	Alex. Siemens
A. A. Campbell-Swinton*	Killingworth Hedges*	Roger T. Smith
	J. S. Highfield	C. P. Sparks*
C. S. Colton	Dr. E. Hopkinson	J. Swinburne
Col. R. E. Crompton	Dr. Gisbert Kapp	Reginald J. Wallis-Jones*
S. Cowper-Coles	J. E. Kingsbury	
S. T. Dobson*	Major W. A. J. O'Meara, C.M.G.	F. J. Warden-Stevens
Philip Dawson*		H. D. Wilkinson*

The electricity sections are as under :—

Class 24.—Plant (steam, gas, oil and water power).
„ 25.—Distribution of electrical energy (switchgear, transmission and transforming).
„ 26.—Utilisation of electrical energy: (*a*) electric lighting ; (*b*) electric traction and propulsion—land, marine and aerial ; (*c*) continuous and alternating-current motors ; (*d*) heating, cooking and domestic appliances ; (*e*) electro-chemistry and metallurgy.
„ 27.—Telegraphy and telephony, land and submarine.
„ 28.—Miscellaneous applications of electricity.

The various classes of engineering exhibits are as follows :—

Class 20.—Steam engines.
„ 21.—Internal-combustion engines and other motors, other than steam.
„ 22.—General machinery.
„ 23.—Machinery tools.
„ 29.—Materials, equipment, and processes relating to civil engineering.
„ 30.—Models, plans and designs for public works.

"Snowed under by Black Soot."—Counsel raised a strong protest against the ventilating arrangements of the Extradition Court at Bow Street, on November 17th.

Mr. Bodkin, after being engaged for a couple of hours on a long case, rose and remarked to the magistrate : I positively cannot sit here all the morning and be snowed under by black soot. It is outrageous. There are heaps of carbon here.

Mr. Marshall Hall, K.C., said : When I go home and put my hand through my hair my hand becomes black.

Mr. Bodkin : It shows so on my friend's head. I do not think there is any remedy for it, for I think it comes in through what is called the gas ventilator.

A window in the glass roof was closed, and this brought about a reduction in the soot that was falling.

Copper.—Mid-monthly statistics bear witness once again to the weight of depression hanging over markets which can keep prices down under such circumstances. English stocks fell during the fortnight ending November 15th from 14,179 tons to 11,921 tons, or 2,258 tons reduction. What are usually termed European visible supplies dropped 1,418 tons, and European supplies, including Rotterdam, Hamburg and Bremen, and estimates for other ports, 1,464 tons. Supplies from North America were under the average, and those from Spain and Portugal were low. Chile shipments were over the average, and Australian just on. Total deliveries at 17,492 tons appeared to show an inactive month. Comparing these, however, with the figures for the whole month, we find that supplies from North America were about one-tenth lower than the average, while Spanish were 857 tons, against an average of 1,154. Chile shipments are a little above the average, and Australian considerably above. The total deliveries, at 40,519 tons, considerably more than double mid-monthly figures. Reductions in stocks for the whole month are : English, 1,285 tons ; European supplies increased 130 tons ; extended European supplies lost 410 tons.

American stocks increased in October 1,238 tons. The world's supply at the end of October had, however, lost 854 tons on the month.

The Physical Society's Exhibition.—This exhibition, which is to be held on Tuesday, the 16th inst., at the Imperial College of Science, South Kensington, will be open in both the afternoon (from 3 to 6 p.m.) and the evening (from 7 to 10 p.m.). Prof. the Hon. R. J. Strutt, F.R.S., will give a discourse at 4.30 on "Spiral Electric Discharges," and Mr. Louis Brennan, C.B., will show some experiments with soap films at 8.30 p.m. Some 30 firms will be exhibiting, and there will also be certain experimental demonstrations.

We understand that invitations have been given to the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Faraday Society, the Optical Society and the Röntgen Society. Admission in all cases will be by ticket only, and therefore members of the societies just mentioned (including also the Physical Society) desiring to attend the exhibition should apply to the secretary of the society to which they belong.

Transmission Lines Patrolled by Aeroplane.—From San Francisco comes an announcement that Robert Fowler, the aviator who recently completed a cross-Continental flight, has arranged with a California transmission company to patrol its high-tension lines leading out of Oakland in an aeroplane. A lineman, equipped with repair apparatus, will ride with the aviator, and the pair will take trips twice a week. The headquarters of this novel inspection crew are to be established at Sacramento.—*Electrical World.*

Electric Lighting on Motor-'Buses.—The London General Omnibus Co. is steadily replacing acetylene with electric lighting on its motor-'buses. A year ago the number of vehicles so equipped was only 226, while now 1,121 are lighted electrically. Following London's example, the Paris General Omnibus Co. is experimenting with electric lighting on its motor-'buses.

Moulders' Strike Ended.—According to a Northampton paper, the strike of moulders and foundrymen connected with two electrical engineering works at Rugby, which had been in progress for 11 weeks, was brought practically to a conclusion at the end of last week as a result of a conference in London between the National Executive of the Engineering Employers' Federation and the National Councils of Moulders and Coremakers' Societies. The basis of settlement recommended was :—"That the men withdraw their demand for the foundries to be strictly 'society' shops, and that an agreement be entered into between masters and men for the avoidance of disputes similar to that recently made at the conclusion of the Sheffield dispute, the Rugby employers undertaking to reinstate strikers now remaining in town as they may be able to take them back."

The I.E.E. "Journal" Criticised.—A correspondent writes, too late for our "Correspondence" columns :—"A few days ago we received a crumpled, flattened roll of printed matter by post. It is our practice to examine postal packets however cheap looking. On examination we found that the crumpled roll consisted of a sort of school magazine arrangement, but purported to be the proceedings of one of the professional institutions of the country, the Electrical Engineers to wit, priced, too, at 3s. 6d. No explanation is vouchsafed as to the alteration in get-up of the proceedings, and the ideas at the back of it can only be guessed. If financial, in view of the large increase demanded in subscriptions from members, they are mean. If the idea is facilitation of illustration, they are not tenable. The Civils can send out monthly parts and bound volumes. The American Institute can do the same. The latter can supply splendid paper, binding, and perfect diagrams on thin bank paper, folded neatly, for a smaller subscription than the English Institution demands. The new form is quarto, the most uncomfortable to handle and awkward to shelve of all book finishes. Why this procedure?"

The intention of the Institution to issue the *Journal* fortnightly, in quarto format, was announced a long time ago. Whether the new style pleases the members or not is for them to say.

Adjustable-Speed Single-Phase A.C. Motors.—Messrs. Greening's Engineering Co., of 15, Clifford's Inn, E.C., send us the following statement by the Wagner Electric Manufacturing Co., of St. Louis, U.S.A. (for which firm Messrs. Greening's are agents in this country) respecting their adjustable-speed self-starting unity power factor A.C. motors, which are being introduced into this country.

The Wagner Co. state that the machines are adjustable-speed single-phase motors, having several idle speeds, and a full-load speed which does not differ very materially from the idle speeds. For instance, the idle speed of a machine might be adjusted for 1,200 R.P.M., and the full-load speed will perhaps be 1,160 to 1,200 R.P.M. The firm are prepared to manufacture motors of ½, 1½, 2 and 3 H.P., at speeds of 900-1,800 R.P.M. ; and 5 H.P., speed 800-1,600 R.P.M. ; these ratings are supposed to be for constant H.P. over the speed range. The machine is designed to have six different operating speed steps and is supplied with a controller of the drum type, connected by a number of leads to different windings of the machine.

There is one starting step on the controller, and the machine will operate on the particular step with a performance similar to that of the firm's present B.A. self-starting single-phase motor.

The adjustment of the speed is obtained without the use of any resistance in the circuit, and, therefore, the efficiencies at all speeds are fairly good and remain constant for all speeds.

The machine has also windings to adjust the power factor.

Central-Station Fires in America.—Our contemporary, the American *Electrical Review and Western Electrician*, reports four central-station fires happening in 10 days as follows :—

On October 16th power plant No. 2, which was being constructed for the Pacific Light and Power Corporation on Big Creek, 75 miles back in the mountains from Los Angeles, Cal., was damaged by fire to the extent of nearly $10,000.

On October 19th, the power plant at Goliad, Tex., was completely destroyed by fire. The loss is estimated at about $25,000.

An explosion occurred in the plant of the Richmond Light and Railroad Co., at Livingston, Staten Island, on October 21st. Six men were killed and four injured, and a portion of the plant was wrecked. There were two separate explosions in the boiler room shortly after five o'clock in the morning. This plant supplied the electric car lines on the island, as well as current for lighting and power.

The Greenspring Electric Light and Power Co.'s plant at Greenspring, O., was almost completely destroyed by fire early on the morning of October 26th.

Institution and Lecture Notes.—Institution of Electrical Engineers.—As the discussion on Dr. Klingenberg's address on the "Electricity Supply of Large Cities" was to be concluded on December 4th, there will not be a meeting of the Institution on December 11th.

At the meeting of the Manchester Local Section on Tuesday last, the paper by Mr. S. Evershed on "The Characteristics of Insulation Resistance" was read and discussed.

Association of Mining Electrical Engineers.—The new Monkton Collieries, Royston, near Barnsley, were visited last Saturday by the members of the Yorkshire branch of the Association. Mr. John Bentham, of Sharlston Colliery, gave a lecture on "Electricity in Mines," in which he said that electric power in mines had come to stay, and it would eventually be applied to practically every mining operation.

A meeting of the Notts. and Derbyshire branch of the Association was held at Chesterfield on Saturday evening. A discussion took place on the paper on "Large Prime Movers and Boilers for Power Houses," read recently by Mr. E. K. Scott. A joint meeting of that branch and the Midland branch of the Association of Colliery Managers has been arranged to be held at Nottingham to discuss the section relating to electricity in the general mine regulations.

Association of Electrical Station Engineers (Manchester Section).—On November 27th a visit was arranged to view the cable works of Messrs. Glovers, Ltd., of Old Trafford. A large party of members assembled and were very cordially received by the officials of the company, and under the direction of Mr. Anderson and his colleagues a very interesting tour of the works was made.

The monthly meeting of the Bradford Branch of the Association was held at the Spotted House Hotel, Bradford, on Tuesday, November 25th, Mr. W. C. Eakin occupying the chair. A communication was read from Mr. C. H. Broadbent (hon. secretary) resigning his position, and this was accepted with regret. Mr. R. D. Spurr was unanimously elected to the vacant position. It was decided to hold a smoking concert some time in January next.

A meeting of the London Section was held at Chandos Hall, November 25th, for the purpose of transacting general business. The Hon. Secretary reported that he had been instructed by the Committee to obtain all information with regard to Lord Cavendish Bentinck's "Weekly Rest Day Bill," which may be presented to Parliament next session, so that the A.E.S.E. can support it if possible. General business meetings were also held last week at Grimsby and Newcastle-on-Tyne; at the latter place it has now been arranged to hold meetings the last Friday in every month at the Hotspur Hotel, Haymarket, at 7.30 p.m.

The Dewsbury Electricity and Tramways Committee consented to receive a representative of the Association of Electrical Station Engineers, on behalf of the charge engineers at the electricity works, at the meeting which was to have been held yesterday.

Greenock Electrical Society.—At the last meeting, Mr. P. Kerr read a paper on "The Entz Reversible Booster," and a lecture on "Steam Turbines," by Mr. J. H. Parker, was delivered. The author acknowledged his indebtedness for the use of slides, &c., to Messrs. The British Thomson-Houston Co., the Brush Engineering Co. and the British Westinghouse Co.

Society of Engineers (Incorporated).—A paper on the "Corrosion and Rusting of Iron," was read by Mr. Eric K. Rideal on Monday last. The author is a supporter of the electrolytic theory of corrosion, and discusses the matter in the light of that theory.

Royal Society.—The new President, Sir William Crookes, was elected and installed at the anniversary meeting of the Society on Monday last. A donation of £5,000 has been made by Sir Jas. Caird, of Dundee, for the furtherance of physical research.

Physical Society.—Prof. J. A. Fleming on Friday last performed a remarkable series of experiments, showing that it was possible to get a mechanical analogy for several of the problems of electrical oscillations that have proved hitherto so complex as almost to baffle mathematical investigation.

At the Mechanics' Institute, Bradford, last week, under the auspices of the Gilchrist Trust, Prof. John Cox lectured on "Lightning and Lightning Rods." The lecture was illustrated with lantern slides and electrical demonstrations.

A lecture on "The Electrification of Railways," was given on Monday night before the Leeds University Engineering Society, by Mr. H. E. O'Brien, who stated that by the development of electrification of railways the business man would be able to live further away from the town, because he could travel with greater speed. In a 40-minutes' journey the mileage could be increased by 25 per cent. Greater ease was another feature of the electric train. Mr. O'Brien spoke of the electric railway as the railway companies' resource to beat the tramway systems, and he instanced in this connection the result of the electrification of a short length of line at Southport, where the Corporation had been driven to such straits that it had stationed a man at the railway station entrance to advise people to patronise the tramway instead of the railway.

Boilers in Central Stations.—We have received the following communication from Mr. J. W. Jackson, of Philadelphia power station, too late for insertion in our "Correspondence" columns:—

"I notice you have generally discussed a paper I read before the Institution of Electrical Engineers, Newcastle Local Section, and am very glad to find that you are generally in agreement with the position taken up.

"I should, however, be glad if you would again refer to my paper on the section dealing with what might be termed 'High-speed Gases.' You will notice that this particular section is commenced by referring to the work done by the late Dr. Nicholson and Prof. Bone in this direction. Both of these gentlemen have reduced the gas temperature at the back of their boilers to a very low figure, and in the case of Prof. Bone, boilers have been working for some time under these very low temperature conditions, and statements are made from time to time that no trace of corrosion is visible, either on the boiler or the economisers.

"From my experience I have no reason whatever to doubt these statements. I have had experience with a good many economisers; at one place there were 18 economisers, some of them with 500 tubes, at other places economisers with 650 tubes, and so I have come across a good lot of corrosion internally and externally, but I am generally of the opinion that the greatest danger that an economiser runs is that due to the temperature of the feed water, and not that due to the gas temperature; but because so many economisers are abused by feeding them with low-temperature water, steps have been taken by various people to galvanise the economiser tubes, and again others by copper-plating them. I, therefore, cannot agree with the latter portion of your leader."

It will be seen that Mr. Jackson does not dispute the corrosion of cold tubes; external corrosion is necessarily due to deleterious constituents of the flue gases, and if the gases were not cooled below the dew point—whether by cold economiser tubes or by cold boiler tubes is immaterial—this corrosion would not take place. We doubt the efficacy of either copper or zinc as a protection against sulphurous compounds.

Pladuram Wire.—The manufacture of tungsten wire, which has done so much to facilitate the progress of the metal-filament lamp towards perfection, is surrounded with technical difficulties rendering the various processes of exceptional interest. We therefore with great pleasure seized an opportunity of visiting the works of Messrs. Duram, Ltd., at Hanwell, where considerable quantities of drawn tungsten wire are now being produced under the name "Pladuram" wire. The works have only been running a few months, the company having entered into occupation in January last; as most of the machines required for the company's special processes had to be made, and the workpeople trained to their operation, under the direct supervision of Mr. Charles Gladitz, the inventor and patentee of the apparatus employed, some months elapsed before work could be begun on a commercial scale; but when one considers that in the course of manufacture of the finest wires, about 0·015 mm. in diameter, the material has to pass through some 380 stages, the wonder is rather that it was possible to install the necessary plant and complete the organisation in a twelvemonth, let alone three months. This result, in fact, was only achieved by the untiring efforts of Mr. Gladitz, who is to be congratulated upon the successful outcome of his labours. We understand that the inventor has been at work on the subject unceasingly for four years, and has been successful in discovering many new facts and principles which play a predominant part in so difficult an undertaking as the production of tungsten wire; and not only is he able to manufacture the metal in a state of almost perfect purity, with certainty and freedom from flaws of any kind, but he can produce it in any form and for any purpose. We have had the pleasure of watching the whole cycle of operations, from the raw material to the ingot of pure metal, and onwards throughout the conversion of the ingot into thousands of yards of wire, which is measured in microns (thousandths of a millimetre), the unit of length hitherto employed mainly by physicists when speaking of the wave-length of light, even the mil being too large a unit for metal filaments. The tensile strength of the wire is astonishing; we saw a wire 20 microns (0·79 mil) in diameter tested, and it broke with a weight of 165 grammes. This corresponds with a tensile strength of no less than 334 tons per sq. in.; the breaking stress of extra plough steel is only 150 tons per sq. in.

All kinds of things can be made of tungsten, now that it is available "in bulk"; it is superior to platinum and iridium for many electrical purposes, such as contact pieces, heating wires for cooking apparatus and radiators, X-ray electrodes, &c., and costs only one-tenth as much; it can be used instead of platinum dishes in chemical laboratories, resisting all reagents except a very few, and being unoxidised by the air up to a temperature of 1,000° C. Its high melting point—3,540° C.—is double that of platinum. No doubt our readers will be able to suggest many other uses for the metal, for the manufacture of which much larger works are now about to be erected. We hope to be able, at no distant date, to give further particulars regarding this remarkable factory; for the present we must content ourselves with expressing our pleasure that a new industry, before which lie unbounded possibilities, has thus been inaugurated in this country, and is giving employment to a constantly increasing number of workpeople.

Electro-Harmonic Society.—The next smoking concert will be held at the Holborn Restaurant (King's Hall), on Friday evening, December 12th, 1913, commencing at 8 o'clock. Mr. Edward Manville will be in the chair. The preliminary programme is as follows:—Vocalists: Mr. Anderson Nicol (tenor); Mr. Humphrey Bishop (baritone); Mr. Denis O'Neill (Irish singer). Prestidigitateur, Mr. Leslie Lambert; Entertainer, Mr. Thornley Dodge; Humorous Sketches, Mr. George Blackmore; Entertainer, Mr. Lindon Wyatt; and a String Quartet (Messrs. Spencer Dyke, Edwin Quaife, James Lockyer and B. Patterson Parker). Accompanist, Mr. Bernard Flanders, A.R.A.M.

For Sale.—Norwich Electric Tramway Co. have for disposal 200-kw. d.c. steam generating set. Particulars are given in our advertisement pages to-day.

Inquiries.—Makers of "Excello" resistance wire are asked for.

London Electricians' Wages Movement.—A meeting of 80 electrical contracting firms was held on Wednesday afternoon, Mr. Bowden, of Poplar, in the chair, and a new Association named the London Electrical Masters' Association was formed, without incorporation; Mr. Bowden was appointed chairman, with Mr. L. G. Tate as secretary. A Committee was appointed to draw up articles, and to go into the questions raised by the Electrical Trades Union, and report to another meeting to be called by the Masters' Association. The first meeting of the Committee will be held on Monday next.

Electric Cable Explosions.—The Board of Trade has appointed Sir T. Edward Thorpe, C.B., F.R.S. (chairman), Mr. Robert Nelson (of the Home Office), Mr. W. Slingo (of the General Post Office), Mr. James Swinburne, F.R.S., and Mr. Alexander B. Trotter (of the Board of Trade), to be a committee to consider the causes of explosions which have occurred in connection with the use of bitumen in laying electric cables, and to report as to any steps which should be taken to prevent explosions in future from the use of bitumen or similar substances. Mr. M. J. Collins, of the Board of Trade, will act as secretary to the committee.

A Remarkable Proposition.—A correspondent wishes to be put in communication with a supply authority which can give a temporary supply of 50,000 amperes at 80-110 volts, D.C. He will bring his plant to the place where current is generated, and pay all expenses of connections, &c., besides paying liberally for the energy consumed. The demand would be made at the period most convenient to the engineer of the supply authority, and would not last more than two or three hours at a time.

There must be many authorities in a position to take up this unusual proposal without much inconvenience.

Appointments Vacant.—Mains assistant and a shift engineer, for Radcliffe U.D.C. (35s. each); assistant to central station engineer, for Sleaford U.D.C.; switchboard attendant for Middlesbrough Corporation (27s.); charge engineer for Paisley Corporation; jointer for Dundalk U.D.C. (37s. 6d.); lecturer in electrical engineering at South African College, Cape Town (£300 +). Particulars are given in our advt. pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Tuesday, the recommendation by the Blackpool Tramways and Electricity Committee to increase the salary of the electrical engineer (MR. C. FURNESS) from £700 to £900 a year, was before the Council. Ald. Brodie, chairman of the Committee, said Mr. Furness was appointed electrical engineer 12 years ago, at a salary of £520. It was subsequently increased to £600, and, on the death of the tramways manager, four years ago, he was appointed to the position, largely as an experiment, his salary being raised to £700. At that time profits on the tramways were £8,425, and they had since increased to £10,053 and £18,331, while for the year ending March next they were estimated at £25,000. Mr. Bamber, in moving an amendment that the recommendation be referred to the General Purposes Committee, said an increase of £200 was a big pill for the ratepayers to swallow, and it would create an undesirable impression among other officials of the Corporation. Mr. Cartledge seconded. He argued that they ought to be more considerate towards the workmen. The amendment was defeated, and the minutes of the Committee were adopted by 22 to 20.

MR. W. T. HELLABY, who has been for the past 7½ years in the West Ham Corporation electricity department, has recently been appointed to a position of assistant sales manager to the County Borough of Sunderland electricity department.

MR. G. MIDDLECOAT, of the Southampton Corporation Electricity Works, is resigning his position with the Corporation and joining the staff of the Edison & Swan United Electric Light Co., Ltd., Ponder's End.

Tramway Officials.—Last Friday, MR. H. KING, traffic manager of the Aberdare Council's tramways undertaking, was presented with a box of cutlery and a silver teapot on the occasion of his marriage. Mr. A. J. Abraham, tramway manager, presided, and made the presentation.

MR. G. PHILLIPSON, overhead lines superintendent at Rochdale, has been presented with a case of pipes and a tobacco pouch by the members of the Corporation Tramwaymen's Club, in recognition of his services in wiring the club premises for the electric light installation.

General.—ALDERMAN H. W. PEAL has been unanimously elected chairman of the Ealing Electricity Supply Committee for the twelfth year in succession.

MR. M. BARRINGTON BAKER has accepted an appointment under the Crown Agents for the Colonies, as Director of Wireless Telegraphs in Zanzibar, and he is sailing this week.

The York Electricity and Tramways Committee has reappointed ALDERMAN MEYER as its chairman and COUNCILLOR DAVIES as its vice-chairman.

COUNCILLOR BONALLACH and COUNCILLOR CARR-SAUNDERS have been elected chairman and vice-chairman respectively of the Stepney B.C. Electricity Supply Committee.

ALDERMAN SMITH and COUNCILLOR WADHAM have been re-elected chairman and vice-chairman respectively of the Barrow Electricity Committee.

COUNCILLOR F. MOSS has been unanimously re-elected chairman of the Public Lighting Committee of the Grimsby T.C., and ALDERMAN T. KING vice-chairman.

Obituary.—MR. S. FALK.—We regret to learn of the death, which occurred on November 29th, at the age of 59 years, of Mr. Salomon Falk, managing director of the well-known firm of Falk, Stadelmann & Co. Mr. Falk was born in Hochberg Wurtemberg, and he came to England in 1876, becoming associated in business with the firm of Julius Ungar, at Commercial Street, London, E.C., who were manufacturers of gas fittings and street lamps. He foresaw that there was a great future before the gas industry, and began business on his own account at 36, Basinghall Street, in 1882, acting as agent for the United Kingdom and Colonies, for Jean Stadelmann and Co., of Nurnberg, manufacturers of gas burners, &c. In addition to this, he established a very considerable business in glassware in connection with the lighting trade. It is interesting to note that at about this time, his invoice journals record the supply of glass shades to Mr. Swan, of York, the pioneer of the incandescent electric lamp.

MR. S. FALK.

From Basinghall Street, he removed to Colonial Building, Hatton Garden, where the business developed into a more general one of lighting fittings and accessories for oil, gas and electricity. Here he was joined by his two brothers, Victor and Max, and a year or two later by Mr. Louis Thurnauer, of Jean, Stadelmann & Co., and so successful were affairs, that in 1887 he formed a limited liability company, with which Jean, Stadelmann & Co. were incorporated, and removed to more pretentious premises at 43, Farringdon Road, where the business was carried on as Falk, Stadelmann & Co., Ltd. These premises, however, were soon found inadequate for the proper conduct of the increasing business, and in 1889 the firm removed to 83, 85 and 87, Farringdon Road, where the surrounding property offered the opportunity of such further extension as the rapidly-increasing business warranted. This foresight of Mr. Falk has since received ample justification by the acquisition by the firm of additional ground space, on which were erected buildings which, probably, in extent exceed that of any other firm engaged in the lighting trade. In the course of time a branch was opened at Glasgow, for the convenience of customers in the North, and later at Manchester. With the advent of the metal-filament lamp, Mr. Falk added to his extensive business of manufacturer and supplier of electrical accessories generally, an electric metal-filament lamp department, which controlled the "Efesca" lamp. Whilst still exercising control as managing director of the firm of Falk, Stadelmann & Co., Ltd., Mr. Falk had of late years taken a measure of relaxation which was justly due to him after his strenuous early business career, and built a residence at Sunningdale, where during the summer months he was devoted to golf, and it was whilst horse-riding to the Esher golf course that he was seized with the heart failure which proved fatal.

MR. W. W. COULSON.—The death is announced, after a few days' illness, of Mr. W. Watson Coulson, secretary to the Oswestry Electric Light Co., Ltd.

ALUMINIUM INSULATION FOR MAGNET COILS.*

THE organic insulating materials commonly used for covering wire only permit a moderate temperature to be attained, if damage is to be avoided. Cotton or silk coverings begin to carbonise at about 80° C., and even the enamel-covered wires cannot stand more than 120° C. When higher temperatures have to be withstood, asbestos coverings have sometimes been adopted, but only at great sacrifice of space, for even a small wire requires a radial thickness of asbestos of about ·35 mm., while the corresponding thickness in double cotton covering is only ·1 mm., in single cotton covering ·05 mm., in double silk ·035 mm., in single silk ·025 mm., and in enamel only ·01 to ·02 mm.

As early as 1883 a patent was taken out by A. Chertemps and Co., of Paris, for a method of insulating unaffected by heat, in which solutions of various inorganic salts were applied to the wire, and after driving off the water of crystallisation, the solid substance remained on the wire as the insulating covering. Mineral oxides, such as clay and magnesia, were found especially suitable for the purpose, and will remain undamaged even up to red heat.

In 1900 Dr. W. Reissig, of Munich, introduced a modification of the above, in which a coating of acid aluminium oxide or clay, dissolved in benzol, turpentine or carbon bisulphide, is used. He found that a coating ·005 mm. thick on a 2-mm. copper wire of a certain length showed an insulation resistance of 102,000 megohms when measured at 122 volts, 25,000 megohms at 245 volts,

* B. Duschitz, in *E.T.Z.* November 20th, 1913.

and 8,200 to 9,000 megohms at 365 volts. The coating is said to be impervious to water, and to stand temperatures up to 250° C.

In 1905 R. Hopfelt employed the well-known fact that aluminium, if exposed to the air, even at ordinary room temperatures, becomes covered with an exceedingly thin, transparent and invisible coating of oxide, which protects the underlying aluminium from further attack from the atmosphere, and which, if removed by scratching or otherwise, soon replaces itself automatically. At higher temperatures the covering becomes denser, but without becoming brittle and flaking off, as is the case with the oxide formed on the surface of heated copper.

Hopfelt found that the natural aluminium oxide coating could safely withstand as much as half a volt. It was, therefore, possible to wind magnet coils with bare aluminium wire provided that some additional insulation was introduced between the layers, where the voltage difference usually exceeds half a volt.

In practice it was found necessary to employ rather special winding machines for this aluminium wire, so as to avoid scraping off the oxide during the process of winding.

The wire is guided into the wooden former between leather pads carried on a screw-driven traveller moving to and fro in front of the former. The rate of traverse of this guide is variable to suit the wire being dealt with. The operator inserts a sheet of pressspahn, paper, asbestos paper, or mica between each layer and the next. The finished coils are then generally taped over, impregnated and dried ready for use. Besides the greatly improved heat-resisting power of such aluminium coils, they show a great saving in weight. Thus a coil which in ordinary copper wire would weigh 27 kg., weighs only 10·7 kg. in aluminium, whilst having the same power. Such coils have proved so satisfactory that they have been largely adopted for lifting-magnet windings, brake magnets, blow-out magnets on controllers, and, especially, for the field windings of traction motors.

Various methods have been suggested for the strengthening of the oxide coating on the wire. One of these consists in winding the coils as described above, and then heating the whole and plunging it into a suitable cold oxidising liquid. The heating of the coil causes the air inside it to expand, and when cooled this draws the liquid into intimate contact with the whole winding. The same result can be attained more simply by plunging the coil, without heating, into a hot liquid bath and then allowing the whole to cool down. Sometimes the oxidised aluminium wire is run through a bath of grease or oil or insulating paint, and is wound into the coil whilst wet. This gives additional mechanical and electrical protection. A specially well oxidised aluminium wire produced by a secret process is on the market under the name of "Aldradraht." The covering is from ·005 to ·02 mm. thick, and is mechanically strong, so that no special care in handling it is required. It stands pressures of several hundred volts, and is not damaged by temperatures of 350°-400° C.

Attempts have been made to obtain the same advantages for copper-wire coils, since this would considerably reduce the dimensions of a coil for a given duty, the resistance of aluminium being about 1·7 times that of copper. Direct oxidisation of copper wire is impracticable, but a method has been patented for use with single layer windings of the edge-wound spiral type. Here the main winding is of copper strip and the various turns of this are separated by a thin aluminium foil spiral about ·025 mm. thick and covered with its insulating oxide coating.

In order to strengthen this coating, the aluminium is preferably run through a bath of ammonium borate or similar liquid, whilst a current is at the same time passed through the strip and the bath. The insulation of the exposed edges of the copper strip is carried out by a transverse winding of the same oxidised aluminium foil. This gives a good heat-conducting covering, which at the same time can safely withstand high temperatures. This process is the property of the British Westinghouse Co.

Another process for obtaining heat-resisting copper coils consists in employing the ordinary cotton or silk-covered wire, but drawing it through a both of plastic inorganic insulating material before winding it into a coil. When complete, the coil is raised to a high temperature, either in an oven or by means of a current, until the cotton or other organic part of the covering is wholly or partly charred, so that the wire remains loosely embedded in a tunnel of the hardened inorganic material. The free space available inside the tunnels is sufficient for all necessary expansion of the copper without damage to the insulation. Such a covering occupies less room than an asbestos covering, but more than the aluminium oxide covering.

NEW COMPANIES REGISTERED.

Electrical Works (Miller), Ltd. (132,404).—This company was registered on November 26th, with a capital of £25,000 in 5,000 shares of £1 each and 5,000 shares of £4 each, to found electrical manufactories in Germany or elsewhere, to light factories and buildings, to provide motive force to electrical machines and movers, to carry on any commercial, financial or other enterprises, &c., to acquire any freehold, leasehold or other property in any part of Europe, &c. The subscribers (with one share each) are:—J. Briggs, 16, John Street, Bedford Row, W.C., solicitor; R. A. Briggs, 15, Dickenson Road, Crouch Hill, N., bank clerk; A. Miller, Weissenburgerstrasse 48I, Bavaria, electrical engineer; E. F. H. Briggs, 16, John Street, W.C., solicitor; F. J. Stevens, 69, South Norwood Hill, S.E., managing clerk; H. S. Briggs, 8, Frederick's Place, E.C., chartered accountant; W. F. Chifferell, 34-7, Cursitor Street, E.C., printer. Minimum cash subscription, £2,000; the number of directors is not to be less than three or more than five: the subscribers are to appoint the first; qualification, £100 shares; remuneration of directors £40 each per annum; of managing director £240 per annum. Registered office, 16, John Street, Bedford Row, W.C.

Northern General Transport Co., Ltd: (132,492).—Registered November 29th, by S. Morse, 1, Kingsway, W.C., Capital £400,000 in £1 shares (150,000 6 per cent. preference). Objects: To carry on in the United Kingdom, Europe and elsewhere the business of tramway, light railway, motor car, omnibus, van, wagon, cab and carriage proprietors, engineers, store and garage keepers, carriers of passengers and goods, manufacturers of and dealers in motors, motor cars, omnibuses, cycles, carriages, trucks, locomotives and other vehicles, with either steam, electric, petrol, oil, gas or other power, electrical and mechanical engineers, electricians, manufacturers of electrical apparatus, &c. The signatories (with one share each) are:—H. S. Day, 1, Kingsway, W.C., director; T. Bower, 48, Victoria Road, Alexandra Park, N., secretary. W. A. Godfrey, 1, Kingsway, W.C., secretary; F. C. Cocking, 109, Woodvale, Forest Hill, S.E., registrar; S. J. Clements, 11, Danecroft Road, Herne Hill, S.E., secretary; J. M. Gray, Gravelacre, Gravesend, tramway manager; C. H. Gilliams, 72, East Sheen Avenue, East Sheen, S.W., secretary. Minimum cash subscription seven shares. The first directors (to number not less than two or more than six) are C. S. B. Hilton, 1, Kingsway, W.C.; C. R. Greene, 6, West Street, Gateshead (chairman, Gateshead and District Tramways Co.); R. J. Howley, 1, Kingsway, W.C.; L. A. Atherley-Jones, K.C., M.P., 4, Paper Buildings, E.C.; and H. S. Day, 1, Kingsway, W.C.; qualification, one share; remuneration, £125 each per annum (chairman, £300). Solicitor, F. A. V. Morse, 1, Kingsway, W.C.

Balm Mills Estate Co., Ltd. (132,478)—This company was registered on November 29th, with a capital of £3,000 in £1 shares, to acquire the Balm Mills Estate, Robertstown, York, together with the property connected with the business of a producer and supplier of steam power carried on by J. J. Jubb, to manufacture and generate gas, steam and electricity for lighting, motive power or otherwise, to carry on business as cotton, woollen and worsted cloth manufacturers, &c. The subscribers (with one share each) are:—J. J. Jubb, Blenheim House, Batley, gentleman; F. A. Jubb, Carlinghow, Batley, clerk; G. H. S. Johnson, Trinity Mount, Dewsbury, warehouseman; J. S. Jubb, Blenheim House, Batley, architect. Private company. The number of directors is not to be less than three or more than five, the first are J. J. Jubb, F. A. Jubb, G. H. S. Johnson and J. S. Jubb; qualification, £50 shares, debentures or debenture stock. Solicitors: Scholefield, Taylor & Maggs, Batley. Registered by Jordan and Sons, Ltd., 116-7, Chancery Lane, W.C.

Norton Griffiths & Co., Ltd. (132,382)—This company was registered on November 25th, with a capital of £100,000 in 50,000 participating preference, and 49,500 ordinary shares of £1 each, and 10,000 shares of 1s. each, to construct, manage, work and control public works and conveniences of all kinds, including railways, tramways, docks, harbours, piers, canals, reservoirs, embankments, irrigations, reclamation, improvement, tunnel, sewage, drainage, sanitary, water, gas, electric light, power supply, &c., in any part of the world. The signatories (with one share each) are:—W. W. Mitchell, 59A, London Wall, E.C., secretary; H. L. Griffiths, 59A, London Wall, E.C., chartered accountant. Private company. The first directors (to number not less than two or more than 12) are J. Norton Griffiths, M.P., and others to be appointed by the signatories. W. W. Mitchell is first secretary.

D. P. Anderson & Co., Ltd. (132,463).—This company was registered on November 28th, with a capital of £1,000 in £1 shares, to take over the business carried on by Isabella V. Anderson, as "D. P. Anderson and Co.," to carry on the business of telegraphic cable and other code compilers, printers, publishers, &c. The subscribers (with one share each) are:—Isabella V. Anderson, Avoca, Orpington, Kent, telegraphic code compiler; L. Worral, West Dene, Beaconsfield Road, Clacton-on-Sea, telegraphic code compiler; H. V. Robinson, Priory Lodge, Tonbridge, Kent, director. Private company. The number of directors is not to be less than two or more than five; the first are Isabella V. Anderson, L. Worrall and H. V. Robinson; Isabella V. Anderson is permanent. Registered office, 10, Philpot Lane, E.C.

Universal Electric Contracts, Ltd. (132,417)—This company was registered on November 26th, with a capital of £1,000 in 100 founders' shares of £1 each and 1,800 ordinary shares of 10s. each, to carry on the business of electricians, electrical and mechanical engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—H. Pinder-Brown, 240, High Holborn, W.C., solicitor; E. V. Allen, Sunby Cottage, Cookham, Berks., company director. Private company. The number of directors is not to be less than three or more than five: the first are J. C. Akerman, R. A. Chambers, E. V. Allen and H. Pinder-Brown; qualification, 100 ordinary shares. Registered office, 240, High Holborn, W.C.

Napier-Kimber, Ltd. (132,381).—This company was registered on November 25th, with a capital of £1,000, in £1 shares, to take over the business of general electrical contractors carried on at 8, Wellington Terrace, Bayswater Road, W., by Cunningham, Ltd. The subscribers (with one share each) are:—R. N. Cunningham, 171, Edgware Road, W., electrical engineer; A. W. Kimber, 14, Belsize Grove, Hampstead, N.W., electrical engineer. Private company. The number of directors is not to be less than two or more than four; the first are R. N. Cunningham and A. W. Kimber (both permanent); qualification £1. Registered office, 8, Wellington Terrace, Bayswater Road, W.

Harraway Bros., Ltd. (132,372)—This company was registered on November 25th, with a capital of £2,000 in £1 shares, to take over the business carried on at 45, King's Road, Chelsea, and 146, High Street, Kensington, as "Harraway Bros.," and to carry on the business of electricians, engineers, suppliers of electricity for light, heat, power, or other purposes, &c. The subscribers (with one share each) are:—H. V. Harraway, 12, South Square, Gray's Inn, W.C., solicitor; J. M. Hawkins, 26, Huddlestone Road, Willesden Green, N.W., secretary. Private company. The number of directors is not to be less than two or more than five; the first are H. V. Harraway and J. M. Hawkins; remuneration, five guineas each per annum; secretary, J. M. Hawkins. Registered by H. V. Harraway, 12, South Square, Gray's Inn, W.C.

Holborn Electric Fires, Ltd. (132,434).—This company was registered on November 27th, with a capital of £2,000 in £1 shares, to take over the business carried on at 2, Devonshire Square, E.C., as the "Holborn Electric Fires," together with certain inventions relating to improvements in electric heating, and to adopt an agreement with A. J. H. Andrews. The subscribers (with one share each) are: A. J. H. Andrews, 2, Devonshire Square, E.C., electrical engineer; Dr. D. H. Jackson, 95, Abbey Road, N.W., consulting chemist. Private company. The number of directors is not to be less than two or more than four; the first are A. J. H. Andrews and Dr. D. H. Jackson; qualification, £50; remuneration as fixed by the company. Registered office, 2, Devonshire Square, Bishopsgate, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £2,000 of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Rawlings Bros., Ltd. (67,908).—Capital, £100,000 in £1 shares (30,000 pref. and 70,000 ord.). Return dated November 4th, 1913 20,685 pref. and 28,169 ord. shares taken up. £58,851 paid. Mortgages and charges: £17,935.

New Phonopore Telephone Co., Ltd.—Mortgage dated November 19th, 1913, to secure £500 and further advances not exceeding £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: A. Haes, 24, Bishopsgate, E.C., and E. Medinger, 27A, Worcester Street, Wolverhampton.

Northwood Electric Light and Power Co., Ltd.—Issue on November 7th, 1913, of £750 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

THE directors' report for the year ended August 31st, 1913, states that the directors have continued their policy of active development during the year, and have expended a further sum of £121,691 on capital account in the provision of additional land, buildings, plant and mains. The area of the districts covered by the company's statutory powers is approximately 155 square miles, and a supply is now available in 302 miles of streets, being an increase of 60 miles during the year. 3,486 new consumers were connected to the mains during the year, bringing up the total number connected to 11,354, being an increase of 44 per cent. as compared with the previous year. The power supply has increased by 22 per cent., the motors now connected being equivalent to 6,270 H.P., while the total connections, including lamps, motors, heating and other apparatus, have increased by 29 per cent., the total units sold by 20 per cent., and the gross revenue by 23 per cent. Important modifications have been made in the scale of charges for electricity for power purposes, which the directors anticipate will lead to a greatly increased demand from manufacturers and others. For the purpose of providing the capital necessary to keep pace with the continued growth of the company's undertaking, a further £25,000 5 per cent. debenture stock was issued during the year at a premium. For the same purpose a further 10,000 ordinary shares were offered to the ordinary shareholders in July last at a premium of £3 per share, ranking for dividend as from September 1st, 1913. The directors are pleased to report that 9,821 of such shares were allotted, and have been paid for in full. To provide for future expansion, a resolution will be submitted at the forthcoming meeting for the increase of the capital by the company by the creation of a further 20,000 6 per cent. cumulative preference shares of £5 each, to rank *pari passu* in all respects with the existing preference shares, and for the issue of such shares as and when the directors think proper for the purposes of the company. The profit and loss account shows a credit balance for the year of £37,857, as compared with £27,623 for the previous year, being an increase of 37 per cent. After payment of the dividend on the preference shares for the half-year ended February 28th, 1913, and of an interim dividend of 5 per cent. on the ordinary shares, there remains, including the amount carried forward from the previous year, an available balance of £28,365, which the directors recommend should be applied as follows:—Dividend on 30,000 6 per cent. preference shares for the half-year ended August 31st, 1913 (paid on September 1st, 1913), £4,500; final dividend of 5 per cent., free of income-tax, on 40,000 ordinary shares, making 10 per cent. for the year, £10,000; 2 per cent. bonus, free of income-tax, £4,000; leaving a balance to carry forward of £9,865. The directors recommend that out of the net premiums received on the above-mentioned issues of debenture stock and ordinary shares, £20,670 be added to general reserve, raising it to £58,000; and that the balance of £9,631 be carried to a suspense account to meet the cost of writing off sundry items of plant which are being removed to make room for new and larger machinery, and also to meet certain contingent liabilities, the amount of which has not yet been ascertained.

Date.	Number of consumers.	Lighting in KW.	Motors in rated H.P.	Total connections.	Total units sold.
Aug. 31, 1911 ..	4,810	4,411	3,986 H P.	8,238 KW.	3,390,580
Aug. 31, 1912 ..	7,868	5,724	5,137 H P.	10,861 KW.	4,516,398
Aug. 31, 1913 ..	11,354	7,7?2	6,270 H P.	14,029 KW.	5,446,488

Mr. George Bookman, chairman of the local board in Adelaide, paid a visit to England recently, and the directors had the advantage of personally conferring with him in regard to the affairs of the company. The directors record with regret the death, in June last, of Mr. W. E. Dalton, one of the company's local auditors. On the recommendation of the local board, Mr. James Counsell was appointed to fill the vacancy.

The meeting is called for Monday next, at Finsbury Pavement House, E.C.

Barbados Electric Supply Corporation, Ltd.

THE annual meeting was held at Basildon House, E.C., on Monday. Mr. A. W. Tait, who presided, said, in proposing the adoption of the report (see ELECTRICAL REVIEW, p. 885), that the results for the year showed a profit of £395, compared with a loss of £467 last year. Although the results were again disappointing, considerable progress had been made. The number of lamps and motors connected of an equivalent of 25 C.P. was 9,430 at June 30th, 1913, which was an increase of 4,020; and the number of consumers connected to the mains was 456, as compared with 247. The growth of revenue had been steady, but the number of units consumed per lamp was still unsatisfactory, and much below European experience. The costs of generation were high, due to the high cost of oil fuel which prevailed during the whole year, and also to the low load factor. They were doing all they could to cultivate the day load, and as they knew, a certain number of small motors had been connected and they were hopeful that that might increase, although the field in that direction was not large. They had, however, for some time been negotiating with the Tramway Co. for the supply of power to them when they converted the line to electric traction. Their general manager, Mr. Shettle, went to the United States to have meetings with the chief parties interested in the Tramway Co., and discussed with them the basis of an agreement for supply. The terms of that agreement had been carefully considered by the directors, and also by their consulting engineers, and they had intimated to the tramway company that, subject to certain modifications which they considered necessary for the safeguarding of their interests, they were prepared to enter into a contract for supply. They had hoped to be able to intimate at the meeting that the alterations which they had suggested had been accepted by the tramway company, but they had not yet received their reply. Even if the contract was signed within the next few weeks, the supply would not be available for a year, because the tramway company had first of all to reconstruct their system, and that company would have to install additional plant and machinery in order properly to fulfil the contract. That would involve the raising of further capital, and he presumed it would only be possible to do that by means of creating further debentures. When the business was definitely concluded, the directors would inform the shareholders as to the arrangements which were suggested in that connection. Since the close of the year the revenue showed a satisfactory increase. For the four months to October 31st it had increased over that for the same period of the previous year by £545, which was equal to an increase of over 90 per cent. As he mentioned last year, the company was still feeling the active competition of the gas company, and the progress which they were making must be considered satisfactory when that was borne in mind. It was somewhat difficult to persuade prospective customers to incur the necessary expense of wiring and fitting their houses for electric light, when the gas company would do that for nothing, charging only an infinitesimal monthly rental. It was also difficult to maintain a proper wiring and fitting staff. The general manager was still endeavouring to persuade some of the local men to take up business as wiring contractors, and he had at last succeeded in inducing one man who had had electrical training to go into the business, and he hoped, therefore, that that would mean an increase in the number of consumers that could be connected. With regard to street lighting, 66 lamps, of an equivalent of 7,200 C P., were erected during the year under review, and since the close of the year a further contract for 20 lamps, of an equivalent of 2,000 C.P., had been obtained for lighting the road to St. Lawrence, and those had now been erected. A contract had also been secured for 23 lamps, of an equivalent of 2 500 C.P., from the Government, for lighting the wharves and inner basin, and that work was now in hand. As he had already mentioned, they had been compelled to pay a very high price for oil fuel. As they knew, oil everywhere had gone up in price, and at present they were under the disadvantage of having to ship practically the whole of the oil required from the United States. They were only able to obtain a small supply locally in the island, and although they had experimented with the Trinidad oil, they had not been able to use it with any success, because it contained so much tarry matter. It might be, however, that when refineries were established there, they might be able to produce an oil suitable to their requirements. They understood, also, that the Mexican Eagle Oil Co. had recently obtained powers to erect an oil storage station near their works for supplying shipping, and if such station was established, there might be a chance of obtaining cheaper fuel, as the oil would then be shipped to the island in bulk in large quantities. The chairman proceeded to refer to the accounts. The capital expenditure during the year amounted to £2,484. That represented expenditure on extensions to mains for public lighting and general service, and for house connections with consumers. In addition to public lighting, the principal extension carried out during the year was that to the suburbs of St. Lawrence. Although the results up to date were considerably behind what was expected, the progress had been steady and encouraging. It took some time to overcome the overhead charges, but when the load reached a certain point, the percentage of costs rapidly decreased with any increase of supply. They believed this point had now been reached, and he hoped that next year they would be able to submit a more satisfactory account. If a contract could be arranged with the tramway company, the progress of their undertaking should be all the more rapid, not only because of the decrease in the total costs of generating, but also because of the increase of activity which it was bound to create among the people.

COLONEL W. F. LEESE seconded the motion, and the report was adopted.

Reduction of Capital.—Brotherton Tubes and Conduits, Ltd., and reduced.—A petition for the confirmation of the reduction of capital from £65,000 to £13,000 has been presented and will be heard on December 9th.

THE TRACTION AND POWER SECURITIES CO., LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital from £2,000,000 to £1,829,180, is to be heard on December 9th.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—A quarterly dividend of 1½ per cent. is announced.

Consolidated Diesel Engine Manufacturers, Ltd.

The directors' report expresses regret that during the period from March 27th, 1912, to October 31st, 1913, the profits anticipated in the prospectus were not realised. The unstable market for fuel oil and the consequent high prices had adversely affected the profits. The general expenses for the 19 months, therefore, exceeded the revenue by £9,600. The new works at Ipswich, in connection with which part of these expenses had been incurred, had only just been completed. It had, therefore, not been possible to obtain any revenue from this source, but the works were now actively engaged in the building of engines, and the first of these was expected to be ready for running by the beginning of the year. In the meantime, orders for engines were being executed at the Ghent works. A number of orders had already been booked for the foundry at remunerative prices, and work was energetically progressing. No dividend for the past year had been received from the investment in Usines Carels Frères, although the balance-sheet of that company, before providing for depreciation on buildings, plant and machinery, showed the profit for the period ending July 15th, 1913, as 724.993.07 fr. (£29,000). This profit was less than was anticipated, and the directors of Usines Carels Frères attributed this falling off to the following reasons:—(1) The war in the Balkans. Messrs. Carels have in the past done a large trade in these countries, and the war has seriously affected this business. (2) The national strike which took place in Belgium in the early part of the year. (3) The high prices which had been ruling for fuel oil and the consequent effect upon the obtaining of orders. And (4) considerable expenses had been incurred in connection with the extensions of the works. These expenses had been met out of revenue, although no benefit from the extensions was derived during the period covered by the accounts. Owing to these special circumstances, the directors of Usines Carels Frères had decided, after writing off depreciation, to apply the balance of profits to writing off expenses incurred in connection with the exhibition at Ghent and in reduction of other charges. Messrs. Usines Carels Frères had now on their books orders totalling over £120,000, including an order of two marine engines of 1,500 B.H.P. each for the British Admiralty, and they were using every effort to keep the figures of the order book as high as the actual conditions of trade will permit.

The adjourned ordinary general meeting of the shareholders was held on Tuesday, at Salisbury House, London Wall, E.C. Mr. J. M. Fells, the chairman, presided, and there was a crowded attendance. The proceedings, which lasted upwards of two hours, were at times very lively, but in the end the appointment of a Committee was agreed to with practical unanimity.

The Chairman said that as he had only quite recently been elected a director he desired to emphasise as clearly as possible the fact that he was presiding at that meeting in a representative capacity. His election as chairman was due to the fact that a number of independent and influential shareholders suggested to the directors that it was desirable that there should be on the board a director who had no responsibility whatever for the past. In what he was about to say he should not attempt to excuse the directors, for they had, in his opinion, been guilty of some grave errors of judgment, and the company should not have been allowed to drift into its present position, matters should have been taken in hand some time ago. Whether those errors of judgment carried any legal responsibilities, he (the chairman), as a layman, could not express any authoritative opinion. His sole duty as regarded the past was to report to them, as fully and frankly as he could without detriment to the permanent interests of the company, what led to the present position. Having referred to the early history of the Diesel engine and its patents, he said that the Diesel Engine Co., of which the Consolidated Co. held some 90 per cent. of the shares, was formed some few years after the date of Dr. Diesel's patents. The first-named company was only a royalty receiving and merchanting company, and its principal contractor was Messrs. Carels Frères. In 1903 the Diesel Engine Co. and Messrs. Carels Frères entered into an agreement of a close and business character, which, with certain modifications, existed until the Spring of last year, when the Consolidated Co. was formed and acquired some 99 per cent. of the shares of the Engine Co. 595,959 shares of £1 each had been issued. From these had to be deducted 172,149 shares, of which 72,149 were issued to the Diesel Engine Co., and 100,000 to Carels Frères, which left 423,810 subscribed in £1 shares. Of that money, £150,000 was paid to Carels Frères in accordance with the terms of the prospectus. £8,500 was paid for preliminary expenses, and £31,716 for underwriting commission and share brokerage. Those three items amounted to £190,000, leaving £233,810 available for the cost of building and equipping works in England, for the manufacture of Diesel engines and for additional working capital to meet the demands of an increasing business. On October 31st last out of that £233,810, £136,560 had been spent on the new works at Ipswich Altogether, £143,357 had been advanced to and invested in the Diesel Engine Co., and the auditors had drawn attention to the fact that, in their opinion, owing to trading losses incurred by that company, which were not provided for in the accounts, that figure was not of the value stated. He (the chairman) was advised that at least £35,000 out of the amount which the company had advanced to the engine company would be irrecoverable. Having dealt with the company's investment in the Usines Carels Frères, the chairman said that the present financial position of the undertaking was such that they must have fresh capital, and their suggestion was that it should be raised on what was known as the assessment principle rather than by the issue of debentures. The commercial record of the associated companies showed that they had business connections in all parts of the world, and that the present volume of business, which was large, was capable of considerable expansion, and he believed that given an efficient board of directors and staff, there was no reason why the company should not earn satisfactory profits. In conclusion, he said that the board had a large majority of proxies which would enable them to carry their report if they so wished, but feeling that the company had a great future, instead of using those proxies and passing the report that day, it was their desire to see a small committee of shareholders appointed to go into the whole history of the company and to report at a subsequent meeting.

Sir William Peat then addressed the shareholders at great length on the position, and gave it as his opinion that it would be necessary to write a very substantial sum off the assets of the Diesel Engine Co. as lost. He pointed out that last year there was a loss of £49,000 in that company due to the fact that the directors had paid that amount of money to persons who had bought Diesel engines which had not come up to the specifications. With regard to the Usines Carels Frères, 50 per cent. of the capital of which belonged to the Consolidated Co., he pointed out that they had paid a quarter of a million for a half interest in that concern although the total capital was only £400,000. Although they got no dividend from that company this year, he was confident, as a result of his investigations, that the business was a good one, and that fine profits ought to be made under proper management. Altogether he estimated that it would be necessary for the directors to write off something like £135,000 to clean up the balance-sheet, and if the proposed scheme of reconstruction went through, the 5s. a share by which the capital was to be written down should be adequate to write off that loss. The scheme further provided for an assessment of 5s. a share, which would produce £150,000. The manager had given him an estimate that when the Ipswich works were in full swing they ought to make £26,000 a year profit, after providing for depreciation. It was evident that the company had got valuable patents and a business worth conserving, and the only course open to the shareholders, short of liquidation, was reconstruction. In his opinion, it was important that they should face the situation boldly and at once, and not allow matters to drift on in the hope that things would improve.

The Chairman then proposed a resolution, to the effect that a Committee of seven shareholders, with power to add to their number, be appointed to inquire into the causes of the present position of the company, to advise as to remedies, and to deal with the question of the new board and the reconstruction scheme; the Committee to report to a further meeting to be held in a fortnight's time, their report being first circulated among the shareholders.

Mr. Davidson, who said he had come prepared to very strongly criticise the action of the board, remarked that, under the circumstances, he would second the chairman's resolution, and would content himself with saying that he hoped nothing would be done to prevent the committee trying to find out who was responsible for the present position, and whether they could not fix pecuniary responsibility upon someone.

Mr. Peddie, chairman of the Shareholders' Committee, and Mr. Lawson having addressed the meeting at some length, the resolution for the appointment of a committee was agreed to, and the meeting proceeded to nominate gentlemen to act on this body.

Burmah Electric Tramways and Lighting Co., Ltd.—The directors announce a dividend of 3 per cent. (3s. per share) on the preference shares, placing £5,000 to reserve for depreciation and carrying £908 forward. According to the *Financial Times*, the directors announce that if proper provision for the upkeep and for depreciation of the system is to be provided, it will be impossible to rely upon paying the full dividend on the preference shares, and consequently there is no reasonable prospect of paying anything on account of the arrears. The directors have formulated a scheme which will be submitted at meetings on December 5th and 22nd.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Stolz Electrophone Co. (1913), Ltd.—60,000 shares of £1 each fully paid, Nos. 1 to 60,000.

And to allow the following securities to be quoted in the Official List:—

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 162,000 preference shares of £1 each fully paid, Nos. 1,838,001 to 2,000,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended October 31st, 1913, amounted to 1,426,639, compared with 1,386,195 units in the corresponding five weeks of 1912.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. for the three months to December 31st on the 6 per cent. cumulative preference shares.

Mackay Companies.—The usual quarterly dividend of 1¼ per cent. on the common shares is announced.

Power Gas Corporation, Ltd.—The directors recommend a dividend of 5 per cent. per annum on the ordinary shares,

Continental.—Germany.—A new company has been formed by the Rheinische Credit Bank, at Mannheim, entitled the Elektrische Kraftversorgung Aktien Gesellschaft, whose objects are for the erection, purchase, promotion, mortgage or working or all kinds of electric installations. The capital is fixed at £400,000. The company is associated with the Brown-Boveri concern, and takes over a series of undertakings from that firm, so that it starts with a prepared portfolio. Eng. Prof. Marguerre is the president.

France.—The report of the Société Electro-Metallurgie de Dives, for the year ending on June 30th last, shows a net profit of £60,616. Of this sum £2,972 is being placed to legal reserve, £1,642 paid to the directors and management, £14,281 to a special reserve fund to provide for fluctuations in the prices of metals, and £40,000 to the payment of a 5 per cent. dividend to the shareholders, leaving a small balance to be carried forward.

Russia.—The report of the Société Russe de l'Electricité Westinghouse, for the last financial year, shows a loss of £72.115, bringing the total loss appearing in the balance-sheet up to £230,652.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The directors report (according to the *Financier*) that the accounts for the year to September 30th show a balance, being profit, of £21,635, compared with £19,769 for the previous year. Owing to the more favourable weather during the past season, the traffic receipts show an increase of £2,291 compared with the previous 12 months. The sale of electricity also increased by £1,399, or nearly 16 per cent. The balance of the revenue account at the disposal of the company, including £2,581 brought forward, is £16,607. The directors propose to pay a dividend of 3 per cent. on the preference shares, which will absorb £4,500, leaving a balance of £12,107. It is proposed to place £2,000 to rolling stock reserve account, to appropriate £6,000 towards future maintenance of permanent way, to add to third-party insurance reserve £1,000, and to carry forward £3,107.

Canadian General Electric Co., Ltd.—The directors have declared a quarterly dividend at the rate of 1¾ per cent. for the three months to December 31st, plus a bonus of 1 per cent., making a total of 8 per cent. for the year, on the common stock.

R. Waygood & Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum (6d. per share), less income-tax, on the ordinary shares for the past half-year is announced.

Electric and General Investment Co., Ltd.—The directors have declared the interim dividend on the preference shares and 1s. per share on the ordinary shares, being at the maximum rate of 10 per cent. per annum for six months ended November 30th, 1913.

STOCKS AND SHARES.

Tuesday Evening.

It has been a case of the Home Railway market first, and the rest nowhere. Investment securities picked up under the leadership of Consols, but the buoyancy was damped by a heavy and unexpected issue of Canadian Government stock. With speculation in American Rails and mining shares shrunk to a minimum, the Home Railway market has matters all to itself, and is attracting a fair amount of business; much of it, however, is of the semi-professional type, and a smart fall on Tuesday, to-day, reflected the ways of profit-scalpers.

The firmness of Home Rails is due mainly to the consideration of the dividend outlook, combined with a reaction in public feeling against foreign gambles which have involved the operator too often in severe and sometimes total loss. The North-Eastern has just arrived happily at a new three years' agreement between itself and its men, and although the railwaymen have given notice to terminate the conciliation boards, this is understood to be a step not entirely distasteful to the companies themselves, inasmuch as it will permit of new arrangements being made likely to be more agreeable to everyone concerned.

Fresh rises occurred in Districts and Metropolitans. The latter have been especially prominent, partly because of the bear account in the stock, partly because of the Great Northern's overtures to the City tube that is now owned by the Metropolitan Railway. But in the reaction the price gave way to 43. Districts shot up on the opening of the new tube to Paddington. East Londons rose to 8 but came back to 7. London and South-Western Deferred stock is coming to the fore in connection with the scheme for electrifying a part of its suburban system. Probably the stock will receive such a dividend at the end of the current year as will give a return of 5½ to 6 per cent. on the money, and it is argued that with electrification of the Thames Valley lines this should be capable of substantial expansion. But, at the same time, it is well to remember that there may also be involved the possibility of a fresh issue of capital to undertake the work.

The Electric Lighting market is very steady, with quiet rises in several issues. Beyond that there is not much to say. People are not selling their shares, but, on the other hand, there has been little fresh demand, and consequently dealings are comparatively few and far between. This, in a negative way, is a good thing, since it shows that the public are not going to be led away into thinking that the County of London Electric Company's Bill will pave the way to a complete metamorphosis of the industry in London. That industry is doing very well, and while the amalgamation of interests would make a considerable difference to profits, its consummation is still a long way off.

Various shares have gained ¼ on the week, amongst them being Bromptons, Chelseas, Kensingtons and South Londons. Debenture stocks are also on the rise, the advances being a point each in several cases.

The market in Mexicans is better for the time being. Well-informed people in London look upon the withdrawal of Huerta—at least temporarily—as already certain, thanks to the fatuous policy of the United States, or, rather, of President Wilson. The present position, in a nutshell, is that the country wants money, that it is not likely to get cash upon reasonable terms until the internal struggles are settled, and that everyone who has a stake in Mexico is eager to see things cleared up as quickly as possible. Mexican Light and Power issues are a little lower, but Mexico Trams have improved, the Common shares rising 2 points and the bonds 1. The group, as a whole, is better. Rio bonds picked up, and there are substantial recoveries in British Columbia Electric Railway issues. Brazilian Tractions went up 2, in sympathy with smart rises in the Government bonds.

Some of the American power and other utility companies' shares—which for a long time past had been almost unsaleable—suddenly came to the front at the end of last week, the prices putting on several points in a day. As may be well supposed, the market in them is an exceedingly tender one. Shawinigan Water Common shares rallied 3 to 138½ upon the steady advance in the company's earnings for this year, and the bonds are ½ higher. Montreal Common went up 4 to 219; and a demand for Electric Development of Ontario bonds carried the price to 96½. Canadian General Issues have risen, the dividend of 7 per cent. being supplemented by a bonus of 1 per cent. There is a wide-spread impression that the new Canadian Government and municipal loans just floated in London will tend to ease the money stringency in Canada very considerably, and therefore advantage, not only the railroads, but the industrial corporations and commerce generally. Lisbon Trams are better at 1¼.

The Telegraph and Telephone list is steady, with no particular alterations worth mentioning. West India and Panama Telegraphs put on 5s., thanks to a little speculative demand at the end of last week, and this had the effect of improving the price of the First Preference also. Marconis slipped back into dulness, both classes of shares showing a slight reaction, although Canadians are well maintained at 9s., and Americans at 16s. 9d. Reuters recovered the dividend of 6s. per share deducted on the Stock Exchange pay-day.

In the Manufacturing group, Castner-Kellners rallied 7/32 upon the statements at the meeting. Small falls occurred in British Aluminium Ordinary and Babcock & Wilcox shares. Consolidated Diesel Engines at 2s. 6d. were unchanged as the result of this week's meeting. Crompton Debenture rose 3; and Willans and Robinson Preference after its 7 points rise, is another 1 to the good at 22½. Rubber shares have gone back, because of the failure of the raw produce to rise to regain the half-a-crown per lb, which it touched a little while ago. Business has fallen again upon quietude, and further developments are wanted to revive renewed interest.

Within a day or two, there will probably appear the prospectus of £175,000 7 per cent. cumulative participating preferred stock, to be offered at par, in the Province of Buenos Ayres Electric Supply Company.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Nov. 26	3,084	+ 293	48	46,240	+ 3,704	..	..
Blackpool-Fleetw'd	„ 29	1,161	+ 114	21	29,0?3	+ 2,790	8	..
Bristol	„ 28	29,447	- 3,257	..	88?,056	+ 51,291	30·5	..
*Brit. Elec. Trac. Co.	„ 21	101,411	+ 9,860	..	..	..	419·8	1·25
Chatham and Dist.	„ 20	3,585	+ 315	46	4,811	+ 2,818	14·98	..
Cork	„ 27	1,8?3	+ 85	47	28,726	+ 685	?·89	..
Dublin	„ 28	19,154	—2,167	..	210,257	—15,?64	54·25	..
Hastings	„ 27	3,1?7	- ?44	..	..	..	19·3	..
Lancashire United	„ 26	6,?6?	+ 1,088	47	7?,641	- 9,08?	42	3
Llandudno-Col. Bay	„ 2?	648	+ 47	51	17,?19	+ 1,480	6·5	..
London United ..	„ 21	28,2?7	+ 1,515	..	296,054	+ 6,086	..	..
Tyneside	„ 19	1,9?3	..	21	11,060	721	11	..
Anglo-Argentine ..	„ 25	?78,018	+ 17,870	47	1,605,049	+189,303	..	..
Auckland	„ 21	10,497	—?,077	21	92,254	— 4,949	25·42	1·81
Brisbane	Sept.	?5,?9?	2,?80	..	28?,7?8	+51,674	..	..
Calcutta	Nov. 19	17,939	+ 991	..	..	+ 9,840	..	..
Kalgoorlie, W.A. ..	Oct.	2,652	..	44	29,099	..	20·5	..
‡Madras	Nov. 15	1,?03	— 14	46	37,?·4	+ 2,597	15·25	1
Montevideo ..	Oct.	29,224	+ 7?6	52	573,635	+27,219	..	..
Cen. London Rly.	Nov. 29	21,060	—1,?61	48	?33,400	5,322	6·78	·4
City & S. Lon. Rly.	„ 29	11,?91	—1,075	48	13?,?80	—12,712	7·26	..
Dublin-Lucan Rly.	„ 28	445	- 1	21½	3,284	— 22	7	..
L'pool Overh'd Rly.	„ 28	6,?·2	+ 472	47	80,586	+ 6,0 6	6·6	..
London Elec. Ry. Co.	„ 29	88,160	— 85	48	653,?45	+ ?25	21·25	..
Mersey Railway ..	„ 2?	5,667	— 186	48	10?,1?3	+ 4,?02	4·5	..
Metropolitan Rly.	„ 2?	72,2?9	+ 6,015	47	809,578	28,239	29·25	8·5
Met. District Rly.	„ 29	51,??1	+ 141	48	62?,?08	+17,?48	25	..

* Includes railways and tramways. ‡ Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9¼ — 10¼	..	6 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10¾	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8¾ — 9	+ ⅛	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94 xd	..	4 5 1
Charing Cross, West End & City	5	5	5†	4¾ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4¼	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 93½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16 — 17	..	5 6 0
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord.	10	6	5†	11½ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	103 —105	+ ⅛	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	+1	4 9 1
Edmundson's, Ord.	£3	..	..	⅞ — 1⅛	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1¾ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4¾ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hov	5	9	8†	7⅞ — 8⅛	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8¼	+ ⅛	4 17 6
Do. 4 % Deb.	Stock	4	4	90 — 92	+ 1½	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅜ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3¾ — 3⅞	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅝	..	4 12 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	+ 1	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	+ 1	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10¾	..	5 11 7
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8¾ — 9	— ⅛	5 11 1
Do. 7 % Pref	5	7	7	6¾ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5⅛	..	2⅞ — 3⅛	+ ⅛	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	97 — 100	+1	5 0 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅜ — 1⅝	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	1⅞ — 2	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord...	5	10	10†	8¼ — 8⅝	..	5 14 8
Do. 4½ % Cum Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	5†	7¼ — 7⅝	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	— ⅛	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	107 —113	+1½	7 1 7
Do. 7 % Pref.	$100	7	7	119 —124	+1	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅛ — ⅛	— ⅛	7 5 6
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 19 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	+1	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ — ½	..	Nil
Do. 6 % Pref.	1	6	6†	11/16 — 3/4	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	10½ —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 4
Mexican El Lt , 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	47 — 51	—1	7 16 10
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	..	8 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 82	— ⅛	6 1 11
Do. 5 % 2nd Mort. Bonds ..	100	5	5	66 — 71	— 2	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 62	..	8 1 4
Montreal, Lt., H. and Power ..	$100	9	10†	216 — 222	+ 4	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	99 —104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	137 —140	+4	4 5 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107	+ ⅛	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	97½ — 99½	..	4 9 6
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	31/32 — 1 1/32	..	6 12 6
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6⅝ xd	— ⅛	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	122 —124	..	6 9 0
Do. Collat. Trust	$1000	4	4	88 — 91	..	4 8 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104¼ —105½	..	5 13 9
Do. Def.	Do.	30/-	..	23¾ — 24⅜	..	6 3 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	+1	4 17 7
Cuba Telegraph	10	6	6†	8½ — 9¼	+ ¼	6 6 4
Do. 10 % Pref.	10	10	10	14½ — 15½	+ ¼	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7⅛	..	6 12 0
Direct United States Cable ..	10	4	4†	6⅜ — 6⅝	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 —129	..	5 8 6
Do. 3½ % Pref. Stock	Do.	3½	3½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12⅛ — 12⅜	..	5 11 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10⅞ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅝ — 12⅜	..	4 19 0
Great Northern Telegraph ..	10	20	5†	30½ — 32½	..	6 2 8
Indo European Telegraph ..	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	78 — 82	..	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph ..	1	20	..	3⅝ — 3¾	— ⅛	5 14 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2½ — 2⅝	— ⅛	6 3 8
Monte Video Telephone, Ord. ..	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	1 1/16 — 1 1/8	..	6 3 1
New York Telep., 4½% Gen. Bnds.	100	4½	4½	97 — 98	+ ⅛	4 11 10
Oriental Telep. and Elec. ..	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9¼ xd	+ ⅛	10 10 6
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6¼ — 6⅝	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2¼ — 2⅜	+ ⅛	4 10 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¼ — 10¼	+ ½	5 17 1
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9⅝	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 12¾	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Tramways, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	..	..
Do. Do. Deferred	100	..	..	4 — 5½	+ ¼	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	3	..	50 — 53	+2	5 13 2
Do. 5 % Perp. Deb.	100	5	5	91 — 94	+1	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	79 — 81	+1	4 18 9
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	—1	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	3/4 — 7/8	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅛ — 2⅜	+1/16	4 15 8
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	1/16 — 1/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	3/8 — 5/8	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	..	6 11 2
Metropolitan Railway Consol.	100	1⅝	1⅛†	43/32 — 43/4	— ¼	3 15 2
Do. Surplus Lands	100	2⅜	2⅜†	58 — 60	..	4 11 8
Do. 3¼ % Deb.	100	3¼	3¼	83 — 85	..	4 2 4
Do. 3¼ % Pref.	100	3¼	3¼	78 — 80	..	4 7 6
Do. 3¼ % Con. Pref.	100	3¼	3¼	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30½ — 31	+ ⅜	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	7/16 — 7/8	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	+4	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	2 — 2⅛	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3⅝ — 3⅞	..	Nil
Do. "A"	1/-	..	..	7/16 — 1/2	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding). Ord.	5	Nil	..	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	3	1½†	3¾ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4 2/16 — 4 3/16	..	5 14 8
Do. 2nd Pref.	5	5⅛	5⅛	4 1/16 — 4 1/8	..	6 3 11
Do. 4 % Deb.	100	4	4	89½ — 91½	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Do. 5 % Deb.	100	5	5	96 — 98 xd	..	5 2 0
Auckland Trams, 5 % Deb.	100	5	5	101½ —103½	+ ½	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10½ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	+2	6 13 4
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7⅞	..	5 3 3
Do. 5 % Pref.	5	5	5	4⅝ — 4¾	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	115 —120	+1	6 13 4
Do Pref. Ord.	100	6	6	103 —107	+ 1½	5 12 2
Do. 5 % Pref	100	5	5	102 —105	+2	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	+1	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5⅛ — 6⅜	..	5 17 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	3/4 — 13/16	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	+ 1/16	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6% B Deb.	100	3	..	10 — 20	..	..

La Plata Elec. Trams, Ord.	1	..	..	3/32 — 1/8	..	..
Do. Pref.	1	4½d.	6	1/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	+ ⅛	4 7 3
Do. 6 % Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	85 — 87	..	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	78 — 81	+2	8 12 10
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 85	..	5 17 8
Do. 6 % Bonds	100	6	6	83 — 86	+1	6 19 6
Para Elec. Lys. & Lt., Ord.	5	10	10†	5⅞ — 6⅛	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96 xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.	1	5⅛	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅞ — 5⅞	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 6 % Bonds	..	5	5	99 —101	+ ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	89 — 91	+1	5 9 11
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	99 —102	..	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5⅛	..	6 13 4
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	93⅛ — 96⅛	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	2/16 — 1/8	..	8 12 4
Do. 6 % Pref.	1	6	6	3/32 — 1/8	..	7 13 4
Babcock & Wilcox	1	16	..	2 1/16 — 2 1/8	— 1/16	5 8 11
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	4 3 6
British Aluminium, Ord.	1	..	..	1 1/16 — 1 1/8	— 1/32	..
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 1/8	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	..	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	5⅜ — 6½	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1⅛ — 1 1/8	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10½ — 11½	..	6 10 5
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	33/32 — 33½	+ 1/32	5 3 5
Do. Deb.	100	4½	4½	102 —105	..	4 5 9

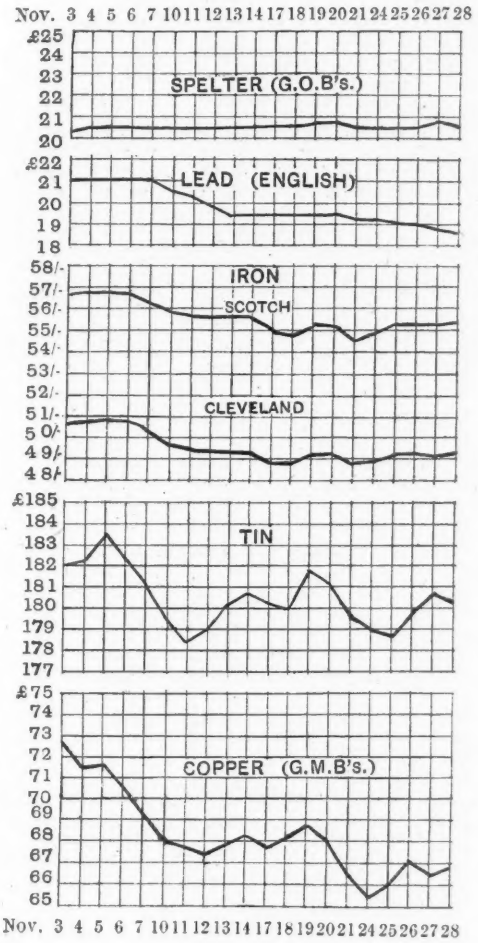
Crompton & Co., Deb.	100	5	5	67 — 72	+3	6 18 11
Dick, Kerr	1	Nil	..	1/16 — 3/32	..	..
Do. Pref.	1	6	6	3/32 — 5/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7
Electric Construction	1	5	..	3/16 — 1/4	..	7 5 6
Do. Pref.	1	7	7	1/2 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6½ — 7½	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15
Do. Deb.	100	4	4	88 — 93	..	4 6
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 8 1
Do. Deb.	100	4½	4½	100½—102½ xd	+ 1½	4 17 1
India-Rubber, G. & T.	10	7½	5	13 — 14	..	5 7
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	54 — 59 xd	..	6 15 7
Do. B 4 % Cum. Pref.	100	..	..	20 — 25	+1	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd 1913.

METAL MARKET.

Fluctuations in November.



New London Showroom for Electric Vehicles.—On Thursday, last week, the new showrooms of Edison Accumulators, Ltd., in Duke Street, W., were opened, Lord Montagu of Beaulieu presiding at an inaugural luncheon held on the occasion.

Mr. W. R. Cooper, in proposing "Prosperity to Edison Accumulators, Ltd.," referred to the earlier failures in accumulator traction due to the defective batteries then employed, and to the advance made in the modern steel-alkali cell, largely used in American electrical vehicles, of which there were 37,000 employed in the States, including 12,000 commercial vehicles. Lord Montagu, in replying, expressed his belief in the favourable prospects before them, and in the merits of the Edison accumulator. He was much impressed by the success of the electric vehicle in the States, for both pleasure and business purposes; the electric runabout could be driven by women and professional men on account of its ease of handling. Reliable test figures showed that the commercial "electric," using charging energy at ½d. per unit, was much cheaper to run than the petrol vehicle, and the prospects for its adoption were very promising. Mr. Bernard Drake, who also replied, referred to his recent American visit, when he found that about 2½d. per car-mile covered all expenses in running an electric vehicle. It rested with the supply authorities to offer a suitable tariff for charging batteries—say, ½d. per unit.

In replying to the toast of "The Guests," Mr. A. H. Seabrook said that greater stress ought to be laid on the use of the electric vehicle for reasons of health. Chicago did not permit steam-hauled trains on its railroads within ten miles of the centre, and he understood that the licensing authorities in Berlin had refused to license any more petrol cabs in the city, although they welcomed electric cabs. The *Lancet* had recently drawn attention to the danger of "petrol haze" in the streets, and such things as these ought to be duly emphasised when the electric vehicle was being considered.

Mr. J. E. Edgcome, who also spoke, said the low tariffs for battery charging had possibly been exaggerated, but the supply engineers would do what they could, and the rates would probably be between 1d. and ½d. per unit.

LISTS OF CONSUMERS.

EVERY supply company has, needless to say, its list of consumers. But the accessibility of these lists varies very considerably, as was discovered recently by a large manufacturing firm, desirous of circularising all the consumers in the kingdom.

Their experiences were interesting. Some municipalities and companies refused flatly to give any information whatever. Others did no more than give a schedule of the streets in which their mains were laid, leaving the advertisers the option of circularising every house therein, or none at all. One ingenious chief of a large metropolitan concern wrote that non-consumers were the people he wanted to see circularised, and offered to send a list of all non-consumers in the streets served by his mains. His offer was promptly accepted, doubtless to his surprise.

Some undertakings, while not objecting to their consumers being circularised, evidently considered their names and addresses delicate secrets to be locked up in the official breast; for they would do no more than undertake to post and distribute the circulars, sent them in bulk in blank envelopes.

The majority, however, were willing to furnish the information desired—for a consideration. It was obvious, from the diversity of the methods by which the information was imparted, that requests for these lists were infrequent. Some asked for a copy of the local directory, which they then marked. Others sent written or typed lists, to be either kept or copied by the advertisers. Only one, a very large provincial town, sent a printed list. Some allowed a representative of the firm to make a copy at their offices; others, while officially refusing to supply a list, would allow one of their own employés to accept a fee for making a copy in his own time.

The fees charged varied widely, averaging from 10s. to 20s. a thousand names. A large Scottish municipality, with 20,000 or more consumers, had so many packets of envelopes sent to them, and presently returned them, mechanically addressed, at 5s. a thousand. At the other extreme, a company owning several small undertakings asked—in vain—for £5 5s. for allowing their list of not more than 1,000 names, all told, to be copied.

Altogether, the firm in question was successful in obtaining the names of some 200,000 consumers, at a total cost of some £150. Whether a smaller firm, or the same firm in other circumstances, would have been equally successful is questionable; but in this instance the majority of the municipalities and companies approached recognised that the current-consuming devices that were to be advertised could do them no manner of harm.

Indeed, it is difficult to see how it can be to their disadvantage to give a list of their consumers to any responsible electrical firm applying for it. Apart from the modest guineas they can charge for the information, the benefit resulting from the use of it would be as much theirs as the advertisers'. There need be no fear of their consumers being annoyed by persistent circularising. The number of firms which can afford to circularise a quarter of a million consumers is strictly limited.—H.R.T.

Electrical Vehicles in Germany.—Just as in England, increasing attention would seem to be now given to the electric vehicle in Germany. The electric tramway authorities of Düsseldorf, for example, have lately put in service an electric motor-tower wagon for use in the maintenance of the tramway overhead conductors. The vehicle, which was built by Messrs. Heinrich Scheele & Co., of Cologne, has a total weight of 3 tons 12 cwt., and can attain a maximum speed of about 17 miles per hour. The machine is equipped with two 6-H.P. electric motors, the necessary current for which is supplied by a battery of Hagen accumulators, capable of running the wagon a distance of 60 miles on one charge. A feature of the machine is that it is designed to be controlled not only from the driver's seat, but also from the top of the platform, so that in carrying out repairs the wagon can be slowly moved along without its being necessary for any of the men to descend. An electric stores wagon, built by the same firm, has also been put in service by the tramway authorities in Dusseldorf. This is capable of attaining a speed of 22 M.P.H., and of running a distance of 50 miles on one charge of the battery.

TRADE STATISTICS OF AUSTRALIA.

The following figures showing the imports of electrical and similar goods into Australia during the year 1912 are taken from the recently issued official trade statistics; the figures for 1911 have been given for purposes of comparison and notes of increases or decreases have been added:

	1911. £	1912. £	Inc. or dec. £
Gas and oil engines.—			
From United Kingdom	114,000	127,000	+ 13,000
,, United States ...	41,000	37,000	— 4,000
,, Germany ...	4,000	3,000	— 1,000
,, Other countries...	9,000	8,000	— 1,000
Total ...	168,000	175,000	+ 7,000
Portable and traction engines.—			
From United Kingdom	120,000	121,000	+ 1,000
,, United States ...	61,000	50,000	— 11,000
,, Other countries...	2,000	—	— 2,000
Total ...	183,000	171,000	— 12,000
Other.—			
From United Kingdom	73,000	380,000	+ 307,000
,, United States ...	10,000	84,000	+ 74,000
,, Other countries...	5,000	5,000	—
Total ...	88,000	469,000	+ 381,000
Dynamo electric machines up to 200-h.p. static transformers, coils, etc.—			
From United Kingdom	141,000	186,000	+ 45,000
,, Germany ...	36,000	50,000	+ 14,000
,, Italy	4,000	10,000	+ 6,000
,, Sweden	6,000	4,000	— 2,000
,, United States ...	90,000	113,000	+ 23,000
,, Other countries...	7,000	8,000	+ 1,000
Total ...	284,000	371,000	+ 87,000
Dynamo electric machines over 200-h.p. and parts.—			
From United Kingdom	17,000	30,000	+ 13,000
,, Germany ...	2,000	2,000	—
,, United States ...	9,000	18,000	+ 9,000
,, Other countries...	1,000	—	— 1,000
Total ...	29,000	50,000	+ 21,000
Regulating, starting and controlling apparatus.—			
From United Kingdom	20,000	26,000	+ 6,000
,, Germany ...	7,000	8,000	+ 1,000
,, United States ...	23,000	50,000	+ 27,000
,, Other countries...	2,000	1,000	— 1,000
Total ...	52,000	85,000	+ 33,000
Coal cutting machines.—			
From United Kingdom	3,000	2,000	— 1,000
,, United States ...	17,000	13,000	— 4,000
,, Other countries...	2,000	1,000	— 1,000
Total ...	22,000	16,000	— 6,000
Earth and rock cutting, excavating, etc., machines.—			
From United Kingdom	34,000	35,000	+ 1,000
,, Germany ...	8,000	6,000	— 2,000
,, United States ...	8,000	8,000	—
,, Other countries...	2,000	1,000	— 1,000
Total ...	52,000	50,000	— 2,000
Rotary and percussive rock drills.—			
From United Kingdom	7,000	5,000	— 2,000
,, United States ...	25,000	23,000	— 2,000
,, Other countries...	—	2,000	+ 2,000
Total ...	32,000	30,000	— 2,000
Machine tools.—			
From United Kingdom	66,000	81,000	+ 15,000
,, Germany ...	11,000	17,000	+ 6,000
,, United States ...	46,000	55,000	+ 9,000
,, Other countries...	4,000	5,000	+ 1,000
Total ...	127,000	158,000	+ 31,000
Electric turbines, economisers, superheaters, etc.—			
From United Kingdom	82,000	61,000	— 21,000
,, Germany ...	1,000	4,000	+ 3,000
,, United States ...	—	5,000	+ 5,000
,, Other countries...	—	—	—
Total ...	83,000	70,000	— 13,000
High speed reciprocating steam engines for coupling or coupled to electric generators or pumps.—			
From United Kingdom	38,000	21,000	— 17,000
Motive power machinery not elsewhere included.—			
From United Kingdom	214,000	260,000	+ 46,000
,, France	11,000	10,000	— 1,000
,, Germany ...	9,000	22,000	+ 13,000
,, Sweden	2,000	6,000	+ 4,000
,, Switzerland ...	3,000	13,000	+ 10,000
,, United States ...	91,000	103,000	+ 12,000
,, Other countries...	3,000	6,000	+ 3,000
Total ...	333,000	420,000	+ 87,000
Electroliers, gasoliers, etc.—			
From United Kingdom	26,000	37,000	+ 11,000
,, Germany ...	1,000	2,000	+ 1,000
,, United States ...	1,000	2,000	+ 1,000
Total ...	28,000	41,000	+ 13,000
Electric fittings, switches, fuses, and lightning arresters.—			
From United Kingdom	29,000	45,000	+ 16,000
,, Germany ...	8,000	10,000	+ 2,000
,, United States ...	9,000	19,000	+ 10,000
,, Other countries...	1,000	4,000	+ 3,000
Total ...	47,000	78,000	+ 31,000
Electric heating and cooking appliances.—			
From United Kingdom	2,000	3,000	+ 1,000
,, United States ...	1,000	1,000	—
,, Other countries...	—	1,000	+ 1,000
Total ...	3,000	5,000	+ 2,000
Electrical and gas appliances not elsewhere included.—			
From United Kingdom	88,000	130,000	+ 42,000
,, Denmark ...	6,000	8,000	+ 2,000
,, Germany ...	47,000	47,000	—
,, Holland	4,000	8,000	+ 4,000
,, United States ...	22,000	45,000	+ 23,000
,, Other countries...	4,000	8,000	+ 4,000
Total ...	171,000	246,000	+ 75,000
Lamps and lampware, and incandescent mantles.—			
From United Kingdom	57,000	84,000	+ 27,000
,, Germany ...	60,000	49,000	— 11,000
,, United States ...	50,000	53,000	+ 3,000
,, Other countries...	13,000	13,000	—
Total ...	180,000	199,000	+ 19,000
Rails, fishplates, etc.—			
From United Kingdom	500,000	845,000	+ 345,000
,, Belgium ...	43,000	125,000	+ 82,000
,, Germany ...	211,000	90,000	— 121,000
,, United States ...	310,000	215,000	— 95,000
,, Other countries...	16,000	25,000	+ 9,000
Total ...	1,080,000	1,300,000	+ 220,000
Telephones, switchboards, and appliances.—			
From United Kingdom	69,000	58,000	— 11,000
,, Belgium ...	18,000	19,000	+ 1,000
,, Germany ...	7,000	6,000	— 1,000
,, Holland	1,000	3,000	+ 2,000
,, Sweden	32,000	44,000	+ 12,000
,, United States ...	10,000	30,000	+ 20,000
,, Other countries...	—	5,000	+ 5,000
Total ...	137,000	165,000	+ 28,000
Wire, iron, and steel.—			
From United Kingdom	111,000	113,000	+ 2,000
,, Germany ...	320,000	299,000	— 21,000
,, United States ...	266,000	304,000	+ 38,000
,, Other countries...	49,000	8,000	— 41,000
Total ...	746,000	724,000	— 22,000
Accumulators, cable and wire (covered), carbon, measuring and recording instruments, arc lamps, etc.—			
From United Kingdom	430,000	587,000	+ 157,000
,, Germany ...	105,000	59,000	— 46,000
,, United States ...	18,000	14,000	— 4,000
,, Italy	10,000	9,000	— 1,000
,, Other countries...	10,000	8,000	— 2,000
Total ...	573,000	677,000	+ 104,000
Arc lamp carbons.—			
From United Kingdom	Included in above.	1,000	—
,, Germany ...		18,000	—
,, Other countries		1,000	—
Total ...		20,000	—

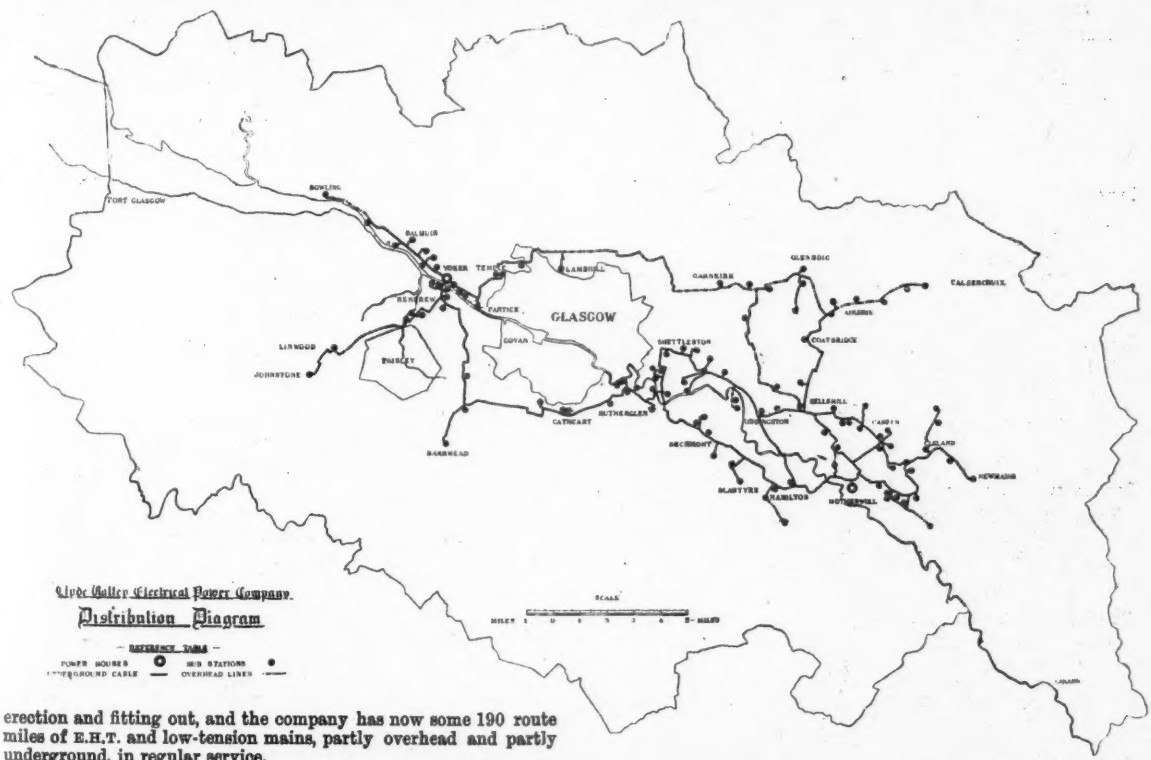
THE CLYDE VALLEY POWER CO.'S UNDERTAKING.

The business of electricity supply for industrial purposes from large central stations is, at the present time, developing rapidly in this country, and there are now numerous industries, both in England and Scotland, which depend on electricity supplied from economically situated generating stations for their power.

We have reviewed from time to time in our columns the various economic advantages accruing to industries through such power facilities, and it may be of interest to our readers to give a few particulars of the scope of operations of the Clyde Valley Electrical Power Co., the largest electricity supply company operating in Scotland, and, indeed, one of the most important now in the United Kingdom.

The Clyde Valley Co. commenced supply late in 1905 from its two generating stations of Motherwell and Yoker, with some 12 sub or distributing stations, an 11,000-volt ring-main system from Motherwell power station, a ring-main from Yoker power station, and four-core distributor cables, aggregating some 56 miles. The business of the company has rapidly extended since then, and its cables cover a very wide area of Lanarkshire, Renfrewshire and Dumbartonshire, as will be seen from the attached plan of the network, which shows the E.H.T. mains, power stations and transforming sub-stations.

The capacity of the generating stations is as follows:—The Motherwell generating station now contains three 5,000-KW. and two 2,500-KW. turbo-generators, while the Yoker plant consists of two 5,000-KW. and two 2,500-KW. turbine sets, a total of 35,000 KW. of generating plant, together with the necessary boilers, condensers, &c.; the transforming sub-stations have increased in number to 113, with some six more in course of erection and fitting out, and the company has now some 190 route miles of E.H.T. and low-tension mains, partly overhead and partly underground, in regular service.



The H.P. of motors connected to the system amounts at the present time to 53,767, with lighting connections equal to 93,126 33-watt lamps, and the company numbers among its customers the best industrial firms in the West of Scotland. Some idea of the diversity of the industries supplied can be gathered from the fact that among the company's customers are collieries, engineers, paper mills, wire rope works, distilleries, soap factories, docks, textile works, bakeries, shipbuilders, bridge builders, tube works, brick works, colour works, ordnance factories, saw mills, printers, iron and steel works, motor-car works, rope works, quarries, chemical works, tramways, dye works, laundries, building contractors, &c., and that supplies in bulk are given to the Burgh of Wishaw, the Coatbridge and Airdrie Electric Supply Co., Ltd., and the Strathclyde Electricity Supply Co., Ltd.

The company has a large amount of mains and construction work on hand in connection with new contracts for supply, the latter having amounted to 8,781 H.P. since the beginning of this year. Prospects for the coming year are exceedingly good, and although the country's volume of trade may be showing a slackening off in certain directions, electricity supply should not be affected to a great extent, as economies must of necessity be introduced in many ways to make up for diminished margins of profit, and one of the most important ways of doing this has been found to be the adoption of electrical driving in place of older and less efficient methods.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We give below, as usual, a list of the proposals that will come forward in the next Session of Parliament. Readers who are desirous of obtaining further information will find the applications published in detail in the last few numbers of the *London Gazette*:—

(*a*) Electric Light and Power.

Ely.—Ely Gas and Electricity Co., Ltd., is applying for prov. order for electric lighting.

Barnsley.—Corporation, power to supply, hire, &c., electrical fittings and apparatus, and other electrical powers.

South Suburban Gas Co.—Powers to generate electricity an enter into contracts and agreements for sale of the same.

Yorkshire.—Further powers and removal of existing restrictions are sought by the Yorkshire Electric Power Co.

Leyland.—Leyland Gas Co. is seeking authority to generate and supply electricity; power to make agreements with the Lancashire Electric Power Co. or other authority.

Brentford.—Brentford Gas Co, power to take over powers of Egham and District Electric Light Co., Ltd.; also to apply for prov. E.L. orders.

North Met. Electric Power Supply Co.—Power to generate electricity at St. Albans, Hertford; power to various railway companies to give supply of energy in bulk to company, &c.

Kenilworth.—Midland E.L. and Power Co., Ltd., is applying for a prov. order.

Hinckley and District.—Midland E.L. and Heat Co. is applying for prov. order.

Beeston and District.—Derbyshire and Notts. Electric Power Co. is seeking a prov. order.

Ripon.—Corporation prov. electric light order.

Bedworth and Bulkington.—Midland Electric Light and Power Co., Ltd., is applying for prov. order.

Hawarden.—R.D.C. is applying for prov. order.

Heanor, Eastwood and District.—Derbyshire and Notts. Electric Power Co. is applying for prov. order.

Merthyr Tydfil.—Merthyr E.T. and L. Co. is applying for amendment of 1899 order as to terms of purchase by local authority.

London.—County of London Electric Supply Co. Application for power to make agreements with L.C.C. for postponement of purchase dates. (See p. 882 of our issue of last week.)

Hightown.—New company to supply gas and electricity in Little Crosby.

Knottingley.—U.D.C., prov. E.L. order.

Bispham with Norbreck.—U.D.C., prov. E.L. order.

Brighton.—Powers to supply electricity in Portslade-by-Sea, Southwick and Shoreham-by-Sea.

Weymouth and Melcombe Regis.—Corporation, sundry further powers relating to the working of the electricity undertaking.

Deal and Walmer.—D. and W. Gas Co. is seeking electricity supply powers for Sandwich and Deal, Walmer, &c.
Worthing.—Corporation, extension of limits of electric supply, &c.
Maidenhead.—Corporation, sundry further powers relating to the electricity undertaking.
St. Annes on-Sea.—U.D.C., authority for showrooms, house-wiring, &c. Also confirmation of agreement with Blackpool, St. Annes and Lytham Tramways Co. as to supply of energy.
Stone.—Application by Stone Gas Light and Coke Co., Ltd., for various powers, including electricity supply.
Wimbledon.—Corporation, sundry provisions relating to working of electricity supply undertaking.
Chiswick.—U.D.C., purchase of undertaking of Chiswick Electricity Supply Corporation, Ltd., and further powers.
Thornton.—U.D.C., prov. E.L. order.
Midhurst and District.—Application for prov. order by B. E. G. Bailey, the Hon. Weetman Pearson and T. Stallibrass.
West Bridgeford.—U.D.C., prov. order.
Llanfairfechan.—U.D.C., prov. order.
Gellygaer (Bedlinog and Fochriw).—U.D.C., prov. order.
Oulton Broad.—Oulton Broad Electricity Co., Ltd., prov. order.
Chorley.—Lancashire Electric Power Co., prov. order.
Banstead.—Walton-on-the Hill, Kingswood and District, application by G. Allom, 15, George Street, Hanover Square, London, for prov. order.
Tenby.—Application by J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.
Warminster.—Application by J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.
Ruthin.—Application by J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.
Ledbury.—Ledbury Electric Supply Co., Ltd., 127, Victoria Street, Bristol, prov. order.
Bradford-on-Avon.—Application by J. H. Edwards, Bristol, for prov. order.
Rickmansworth and Chorley Wood.—Colne Valley E.S. Co., Ltd., prov. order.
Kingston-upon-Hull.—Corporation, extension of area, to include Sutton.
Leeds.—Corporation, extension of area and acquisition of undertaking of Roundhay and District E.L. Co., Ltd.
Ystradgynlais.—R.D.C., prov. order.
York.—Corporation, extension of area.
Newton-in-Makerfield.—U.D.C., prov. order.
Cowbridge and Penybont.—South Wales Electric Power Distribution Co., prov. order.
Yeovil.—Petters, Ltd., Yeovil, prov. order.
Abercarn.—South Wales Electric Power Distribution Co., prov. order.
Skegness.—U.D.C., power to supply gas and electricity and to acquire undertaking of Gas Co., also motor-omnibus powers.
Llanidloes.—Llanidloes E.L. Co., Ltd., prov. order.
Dearne Valley.—Constitution of joint board to exercise electric lighting powers in the U.D.C.'s of Wombwell, Wath-upon-Dearne, Bolton-upon-Dearne and Thurnscoe.
Farnham.—Farnham Gas and Electricity Co., extension of supply area.
Feltham and District.—Application by F. H. Edwards, Mandeville, Platt's Lane, Hampstead, for prov. order.
Harwich.—Corporation, prov. E.L. order.
Reading.—Reading E.S. Co., Ltd., supply in bulk to York Town and Blackwater Gas Co.
Slaithwaite.—U.D.C., prov. E.L. order.
Watford.—U.D.C., extension of area to include Bushey Urban District and Aldenham parish.
Whitstable.—Whitstable Electric Co., Ltd., 94, High Street, Whitstable, prov. order.

(*b*) Electric Tramway and Railless Trolley Vehicles.

Birmingham.—Corporation, further tramway and motor-omnibus powers.
Birkenhead.—Corporation, power to run motor-omnibuses in various districts as part of tramways undertaking.
Bolton.—Corporation, new tramways, trailer cars, motor-omnibuses, further electrical supply provisions.
Bournemouth.—Proposed new company to run railless trolley vehicles in the County Borough.
Bristol.—Corporation, powers to work tramways to be purchased, or leased, from the Bristol Tramways and Carriage Co.
Chesterfield.—Corporation, further tramway powers; extension of area for supply of electricity in Brampton, Walton and Tapton Parishes.
Leeds.—Corporation, tramway and trolley vehicle routes within and without the city; motor-omnibuses.
London.—L.C.C., construction of tramways, street widenings, and various incidental powers.
London United Tramways.—Various powers.
Manchester.—Corporation, extension of time for tramways construction, running of omnibuses, generating station, &c., in Davyhulme, extension of area to include Davyhulme and parts of Stretford and Salford; also purchase of undertaking of Stretford Power and Light Supply (1902), Ltd.
Newcastle-on-Tyne.—Corporation, powers to construct tramways in Longbenton and Weetslade.
Newport.—Corporation, tramway and motor-omnibus powers, also extension of electricity supply limits to include parishes outside borough.
N.E.R.—Power to construct and use trackless trolley system along a specified route in Newcastle-on-Tyne and Gateshead.
Norwich.—Additional tramway powers are sought by the Norwich E.T. Co.
Oxford and District.—City of Oxford E.T., Ltd., powers relating to sale of undertaking to Corporation, removal of same and the running of motor-omnibuses.
Poole, Sandbanks and Westbourne.—Sandbanks Railless Electric Car Co., Ltd., seeks powers to run railless trolley vehicles in the borough of Poole. Agreement with Bournemouth and Poole Electric Supply Co. for supply of electricity.
Preston.—Corporation, tramway and motor-omnibus powers.
Reading.—Corporation, additional tramways; trolley vehicles and omnibuses.
Rotherham.—Corporation, electric tramway powers.
Sheffield.—Corporation, new tramway and motor-omnibus powers.
Walsall.—Corporation, trolley vehicle powers, also motor-omnibus and trailer car provisions.
York.—Corporation, powers to run electric trolley vehicles along routes within the city; further powers to supply electricity, &c.
Western Valleys, Monmouthshire.—Western Valleys (Mon.) Railless Electric Traction Co. is applying for extension of authorised routes, and other powers.

(*c*) Railways, &c.

L.B. and S.C. Railway.—Widening and other powers, including provisions as to agreements relating to the supply of electricity.
Midland Railway.—Powers to extend time limited by Sec. 21 of the Midland Railway (L.T. and S.R. Purchase) Act, 1912; agreements with Metropolitan District, London Electric and Whitechapel and Bow Railway Companies, and Underground Electric Railways of London, Ltd.
Met. and G.N. Railway Companies.—Joint Committee, to lease and work G.N. and City Railway; construct new railways in the City of London, Finsbury and Islington; sundry incidental powers.
London Electric Railway Co.—New subways and works making connections with the Central London Railway, &c.
Central London Railway.—Enlargement of portion of tunnels, new subways and works, additional capital, &c.
N. and S. Shields.—New company, to construct underground railway between N. and S. Shields, generating station, payment of interest out of capital, agreements with municipalities, and light and power companies as to purchase of electricity.
London.—City of London, various powers to Corporation, including regulation of premises on which celluloid is manufactured or stored.

THE CHARACTERISTICS OF INSULATION RESISTANCE.

By S. Evershed, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, November 26th, London, November 27th, and Cardiff, Dec. 1st*, 1913.)

(*Continued from page* 895.)

It has been the custom ever since the early days of submarine telegraphy to observe the total current at the end of the first minute, and to call the ratio of the charging voltage to that current "the insulation resistance after one minute's electrification," a custom which is still adhered to by cable-makers. Inspection of the curve in fig. 6 shows that at one minute 86 per cent. of the total current was charging current, only 14 per cent. being true leakage current. Hence when a cable-maker specifies the resistance of cable similar to this as so many megohms, his statement only contains 14 per cent. of the whole truth. Economy of truth, however, is on the side of honesty in this instance, and the buyer is doubtless aware of the customary method and sometimes understands what it implies.

In this paper we are more concerned with fact than custom Fig. 6 shows that at one minute the total current was 0·0051 micro-ampere at 525 volts, hence the value of what may be called the "customary resistance" was 525/0·0051 = 103,000 "megohms" for $\frac{1}{16}$th of a mile of cable: and the customary resistance of one mile of similar cable would be 103,000/16, or roughly 6,000 "megohms." The final value of the current being 0·00072 micro-ampere, the real dielectric resistance was 525/0·00072 = 730,000 megohms for $\frac{1}{16}$th of a mile, equivalent to a dielectric resistance of 45,000 megohms for one mile of similar cable.

With these figures as a guide, let us ascertain the relative importance of dielectric leakage and moisture leakage in some installation of interior wiring in which rubber-insulated wires are used. The circuits which gave the characteristic curve shown in fig. 5 afford a good example, being carried out with rubber-covered wire insulated to the same standard as the flexible we have just examined. The conductors also are of the same diameter in the two cases. The installation contains 380 yd. of wire, coupled up in the usual way to a number of fittings in which porcelain is used exclusively as the insulator. Assuming the covering of the wires to be undamaged, the dielectric resistance of 380 yards of wire to earth will be about 45,000 × 1,760/380 = 200,000 megohms, and the customary resistance would be about 6,000 × 1,760/380 = 28,000 "megohms." We need not attempt to decide which of these values

is to be taken, because it is only necessary to look at fig. 5 to find that the resistance of the installation as a whole was but a paltry six megohms, even when tested in dry weather. The relative importance is now obvious; leakage through the dielectric rubber is nothing, leakage at the fittings is everything.*

What has been demonstrated in the case of rubber must be equally true with regard to any insulator which has a resistance in any degree comparable with that of good rubber. The resistance of such materials as ebonite, sulphur, glass, mica, gutta-percha, shellac, dry paper, and dry cotton, is in every case enormous; like rubber, their specific resistance is measured by millions of megohms, and in most cases by thousands of millions. Hence dielectric leakage will be ignored in what follows.

Moisture Curves.

Cotton.—Although this material is so largely used as an insulator for wires the opportunity for observing its resistance seldom or never arises in practice. Several test-pieces were therefore made up for the purpose, each consisting of two cotton-covered wires wound side by side in a single layer on a well glazed porcelain bobbin so that leakage from one wire to the other could only take place through the cotton coverings. One of these cotton test-pieces when tested for insulation resistance from one wire to the other gave the curve shown in fig. 8. After being dried in an

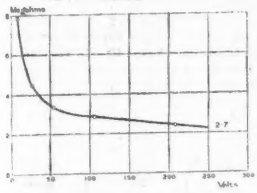


Fig. 8.—Insulation Resistance of Cotton which contained a Normal Quantity of Moisture.

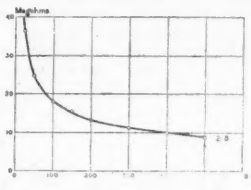


Fig. 9.—Insulation Resistance of Cotton after Drying.

oven at 150° C. for a couple of hours, and then allowed to cool, this test-piece gave the curve shown in fig. 9. The resistance is now five or six times greater as the result of the partial evaporation of the moisture originally contained in the cotton, but the general character of the voltage-resistance curve is unaltered. It will be noticed that at 500 volts the resistance has fallen to about one-third the value it had at 50 volts, or $R_{50}/R_{500} = 2{\cdot}8$. In the diagrams the value of the ratio R_5/R_{10}, is marked at the end of each characteristic curve, so that different curves may be readily compared; in the case of absorbent materials this ratio is more commonly nearer two than three. After further drying at 150° C. for some hours, this same test-piece gave the curve shown in fig. 10. The effect of the drying process has been to increase the resistance to something like 80 times the initial value, but notwithstanding the great diminution in the quantity of water in the cotton, the curve retains the characteristic shape.

Various kinds of paper, under a variety of conditions as regards moisture, compression, length and area, were exhaustively tested.

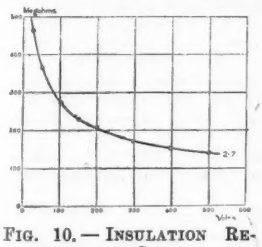


Fig. 10.—Insulation Resistance of Cotton; the same Test-piece as in Figs. 8 and 9, after further Baking.

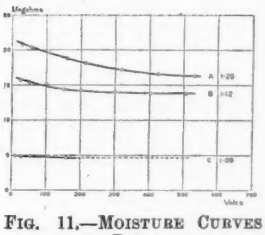


Fig. 11.—Moisture Curves of damp Paper, showing Gradual Change from Moisture Condition to Ohm's Law as the Paper becomes sodden with Water.

As might be expected, paper behaves in much the same way as cotton.

The law of the characteristic curve is considerably affected by the degree of compression to which the absorbent material is subjected.

The degree of moisture in an absorbent material, like paper, may be varied within wide limits without much affecting the law of the moisture curve, although the corresponding variations in the resistance will be enormous. But when the material contains a considerable excess of moisture, so that it is sensibly damp, the law begins to change, the ratio R_5/R_{10}, gradually approaching unity as a limit and the curve subsiding into a horizontal straight line. In other words, when an absorbent insulator is sodden with water its resistance follows Ohm's law. This gradual change from a moisture curve is illustrated in fig. 11, the curves being obtained from paper in which increasing quantities of water had been absorbed. Owing to the very low resistance of the wet paper, curve C could not be continued beyond about 160 volts.

The test-pieces for examining micanite cloth were made up by wrapping a single thickness of the cloth round a piece of smooth iron pipe, and then winding a single layer of cotton-covered wire tightly over it. The cloth was therefore tested under much the same conditions as are commonly met with in practice, micanite cloth being largely used as an insulator for windings.

The test-piece was baked for about four hours at 150° C. In one hour after removal from the oven the test-piece was cold and its resistance was then about 1,300,000 megohms when tested at 500 volts. It was then left exposed to the air of the experimental room in order to find out to what extent micanite cloth acted as an absorbent of atmospheric moisture. The two curves given in fig. 12 were obtained after exposure to the air for five days and 90 days respectively.

In these curves the ratio R_{50}/R_{500} is much less than 2; the average value deduced from seven curves obtained from micanite cloth test-pieces is 1·47.

The three examples which have just been examined are typical of the whole. The composition of the insulating substance seems to be of little importance. So long as the structure of the

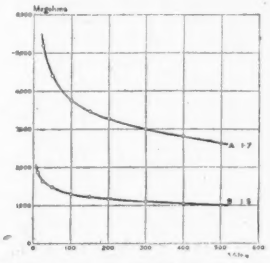


Fig. 12.—Micanite Cloth Tested after Exposure to the Air for (A) Five Days and (B) 90 Days.

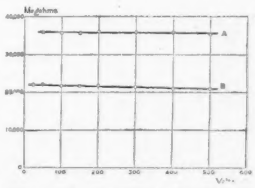


Fig. 13.—Resistance of Cylinder Oil; (A) when dry; (B) containing a Trace of Absorbed Water.

material is such as to provide capillary spaces to harbour moisture, leakage will take place in the characteristic manner. In the following sections the effect of filling up the pores of absorbent materials is dealt with in connection with oiled paper and varnished windings.

Oils are good insulators in themselves, but they are capable of absorbing traces of water. An investigation was therefore made to ascertain whether water when absorbed in oil behaved in the same way as moisture in an absorbent solid. Several different kinds of oils and varnishes (and also liquids which are used as solvents in varnishes) were tested in this apparatus, and in every case Ohm's law was followed, the resistance proving to be a constant quantity not varying with the potential difference between the electrodes. The result of a test with oil containing absorbed water is shown in fig. 13, the upper curve being obtained from cylinder oil freshly drawn from the storage tank and the lower curve from the same oil after absorbing water. The effect of the absorbed water is evident in the marked lowering of the resistance. But of any effect like that due to moisture in absorbent solids there is no trace. In both curves the resistance is practically constant, Ohm's law being followed well enough.

Paper containing moisture may be saturated with an insulating oil without producing any effect on the leakage paths formed by the water. The curve shown in fig. 14 was obtained from drawing paper which, while in a normal state as regards moisture, was immersed in dry cylinder oil and left to soak for a week before being taken out and tested. The resulting curve does not differ in any way from an ordinary moisture curve, the ratio R_{50}/R_{500} being 2·1 for the oiled paper. It is evident that the oil does not displace the water, or break up the conducting paths, or interfere in any material way with the characteristic conduction due to the moisture which was present in the paper before the entrance of the oil.

The converse, however, does not hold good. Water will not only find its way into paper which has been dried and soaked in oil, but will so far displace the oil as to form leakage paths. As is well known, paper impregnated with oil easily absorbs water from the air. Hence the necessity for the lead covering and soldered joints of an impregnated paper cable.

Although water ultimately finds its way into impregnated paper, the process of absorption is extraordinarily slow.

The experiments on oiled paper lead irresistibly to the conclusion that the mode in which absorbed water forms conducting

* It may be remarked in passing that the average resistance per leakage point is a useful criterion for the insulation of wiring. In the case of the resistance from wires to earth, the switches, fuse-blocks, ceiling roses, lampholders (if they can leak to earth), and other places where the conductors are fastened to leaky insulators, constitute the leakage points. For resistance between the wires with the switches closed and the lamps removed, the lampholders alone are to be counted; and for resistance between the wires with the lamps in place and the switches open, the switches are the only leakage points that count.

In the example considered in the text the resistance to earth was about 6 megohms, and there were 62 leakage points, hence the average resistance per leakage point was $6 \times 62 = 372$ megohms. Remembering that one switch base of good quality may have a resistance as low as 100 megohms, it is evident that the installation as a whole was in excellent condition as regards insulation.

Rules based solely upon the number of lamps are frequently too remote from the facts to afford much guidance.

paths is substantially the same whether the insulator is saturated with oil or not. The water may be in the insulator before impregnation with oil or it may be very slowly absorbed afterwards, but once inside it will conduct electricity just as though the oil was not there.

Varnish is intended to prevent water from forming leakage paths. To do this it must either keep out water by closing all the pores at the external surface of the insulator, or it must interpose a solid and impervious layer of the body of the varnish between the conductors and the porous insulator. Applying varnish by a brush aims at the first alternative, vacuum methods aim at the second. It need hardly be pointed out that when a porous body is saturated with a liquid varnish, and the solvent is then dried out, the solid body of the varnish remaining in the insulator is necessarily insufficient in quantity to fill up the pores. They can only be entirely filled up by soaking the insulator in oil, or in a melted wax or in some equivalent solid insulator which can be liquefied by heat. Hence a porous insulator, even when varnished, is likely to have many channels available for the reception of water. Whether water can find its way into them depends on how far the varnish has been able to stop up the pores on the outside of the insulator.

Experiments on varnished windings occupied many months. Their outcome can be summed up in a sentence. Varnish reduces the extent to which moisture is absorbed, but it seems powerless to stop absorption altogether if the windings are subjected to the temperature variations which occur in ordinary use. This failure to exclude moisture was exhibited in every trial, both by test-pieces varnished by a vacuum method and by those which had received coats of varnish applied by a brush. A couple of tests will illustrate the whole series.

One of the test-pieces, composed of two cotton-covered wires wound on a porcelain bobbin, had an initial resistance of 34,000 megohms after being varnished by the vacuum method with a black plastic varnish of good quality. The resistance followed Ohm's law, being constant at all pressures up to 500 volts, thus indicating conduction by the varnish and the absence of moisture conduction. Yet after exposure to the air of the experimental

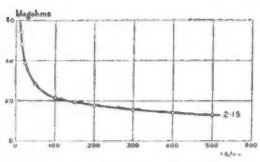


Fig. 14.—Insulation Resistance of Paper which had been Soaked in Dry Cylinder Oil for a Week.

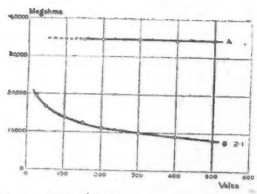


Fig. 15.—Insulation Resistance of Varnished Cotton: (A) 12 Hours and (B) Nine Days after Baking. Showing the Change from Ohm's Law to Moisture Conduction.

room for nine days this test-piece gave a perfectly normal moisture curve with a ratio R_{50}/R_{500} equal to 2·1, and the resistance had already fallen to less than one-fourth of the initial value. The fall in resistance and change in the law of conduction are shown in the two curves in fig. 15. The resistance continued falling for several months and ultimately settled down round about 2 or 3 megohms, rising and falling with the changes in the humidity of the air.

Another test was made on one of the windings used for testing micanite cloth. Two coats of the plastic varnish were applied by a brush to the outside of the winding, and the test-piece was then baked at 150° C. for 32 hours, by which time the varnish was quite dry. After allowing the test-piece to cool, the resistance from the winding through the micanite cloth to the iron core was about a million megohms. This high value was not maintained for long. Within 20 days after removal from the oven a decrease was noticeable, and by the seventy-fourth day the resistance had fallen to 33,000 megohms. The curve obtained on that day is given in fig. 16. It should be compared with the curves given

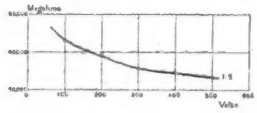


Fig. 16.—Insulation Resistance of Varnished Micanite Cloth (compare with Fig. 12).

in fig. 12 for a similar micanite cloth test-piece which had not been varnished. Both curves indicate leakage through moisture, but the varnish has in this case greatly reduced the amount of moisture which the insulation can absorb.

There can be little doubt that the failure to exclude moisture altogether is due to insufficient elasticity in the body of the varnish. Unless this is a highly elastic substance it is unable to follow the expansions and contractions of the windings, and ultimately the continuity of the coat of varnish is broken up, leaving numerous crevices by which moisture can enter.

Questions naturally arise as to the volume of water which is utilised in forming leakage paths, and what sort of relation that volume bears to the total volume of water in the absorbent insulator.

To find some answer to these questions experiments were made on the resistance of an absorbent insulator containing known quantities of water of a measured specific resistance. The insulator was composed of a number of circular disks of chemically pure filter paper, 12·5 cm. in diameter, piled up into a pad and moderately compressed between two flat metal electrodes. The pad of paper had an area of 122 sq. cm., and its thickness (under the compression) was 0·53 cm., so that the pad occupied a volume of 64·8 cubic centimetres. The specific resistance of the water used in this experiment was 2,500 ohms.

To begin with, a quantity of the water was put into the paper and left to distribute itself uniformly. The method of experiment was to measure the resistance of the pad and weigh it immediately afterwards. Next, to allow some of the water to evaporate and then to repeat the resistance test and the weighing. Proceeding slowly step by step, the water was finally dried out and the net weight of the dry paper ascertained. In this way a number of corresponding values were obtained for weight of water in the paper and resistance of the pad. The figures are given in Table I, the volume of water in cubic centimetres being taken as equal to the weight in grammes.

TABLE I.

Test-point.	Volume of water in the pad of paper, c.c.	Resistance of the pad at 500 volts (megohms).	Estimated volume of resistance water, c.c.	Ratio of resistance water to total water, expressed in parts per million.	Percentage volume of water in the pad of paper.
A	1·68	93	188×10^{-6}	112	2·59
B	1·55	131	134 "	87	2·39
C	1·48	179	98 "	66	2·28
D	1·43	226	78 "	54	2·20
E	1·29	369	48 "	37	1·99
F	1·14	845	21 "	18	1·75
G	1·08	1,280	14 "	13	1·66
H	1·00	1,870	9·4 "	9·4	1·54
I	0·59	23,600	0·74 "	1·3	0·91
J	A trace	$11·7 \times 10^6$	—	—	0

Remembering that the resistance of a centimetre-cube of the water was only 2,500 ohms, it is obvious by inspection of the figures in the second and third columns that the resistance of the pad is out of all proportion to the volume of water it contains.

Under the conditions at Test H the proportion of resistance water to total water was only 9·4 parts in a million. In the table certain assumptions have been made. Thus, the average length of the leakage paths has been assumed to be five times the distance between the electrodes; the dormant water has been assumed to occupy blind alleys entirely off the paths of the leakage current; and the conductivity of the water in the pad of paper has been assumed to remain constant notwithstanding evaporation.

Taking all these matters into consideration, the figures given in Table I seem more likely to be over-estimates of volume than under-estimates. At all events, they may be accepted as of the right order of magnitude, and the significance of the experiment stands out clearly in spite of some unavoidable guesswork. A vast proportion of the whole volume of water in an absorbent insulator is dormant in the sense that it does not form an appreciable part of the observed resistance. The resistance of the leakage paths through the insulator is determined by an exceedingly small fraction of the absorbed water.

The relation between the volume of resistance water and the total volume is shown as a curve in fig. 17. The total volume of

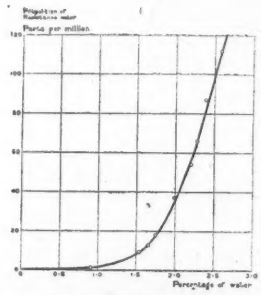


Fig. 17.—Proportion of Resistance Water to the Total Quantity of Water in a Pad of Paper (see Table I.)

absorbed water in the paper is here reckoned as a percentage of the volume occupied by the pad of paper.

Incidentally, the weighing experiment affords another example of the relative importance of moisture conduction and dielectric conduction. Referring once more to Table I, we see that when the absorbed water was reduced to a mere unweighable trace, the resistance of the pad of filter paper rose to nearly 12 million megohms, corresponding to a specific resistance of about 2,700

million megohms (cm. cube). This is far below the specific resistance of more thoroughly dried paper, which is certainly not less than 26,000 million megohms, a value obtained by the British Insulated and Helsby Cables in their test room with carefully dried paper. It is evident that in Test I moisture conduction was at least 5,000 times greater than dielectric conduction, and in Test A, when the pad of paper was much nearer a normal state as regards the quantity of absorbed water, moisture conduction outweighed dielectric conduction more than a million times.

The fact that it has been possible to compare one curve with another without taking potential *gradient* in the insulator into account is sufficient proof that the curves have some simple property in common. In every case in which moisture conduction alone controls the resistance curve, it is found that over a considerable length along the curve the ratio $R_v/R_{10\,v}$ is fairly constant, whatever may be the value of v in volts. Hence, although the insulators have varied widely in thickness, the ratio R_{50}/R_{500} has served quite well as a rough guide for comparing the different curves. A good example of this property is afforded by the moisture curve for cotton given in fig. 9. Half a dozen ratios of $R_v/R_{10\,v}$ read off from this curve are remarkably constant, and point to a definite law, expressed empirically by the formula—

$$R = k \sqrt[x]{1/v}$$

and since in this particular curve the ratio $R_v/R_{10\,v}$ is only a little less than $\sqrt{10}$, the exponent x must be a number not much greater than 2. The formula is only useful as an indication of the general character of the moisture curve. In 47 curves obtained from insulation, composed entirely of absorbent materials, such as cotton, paper, cardboard, fibre, and other things, both varnished and unvarnished, and including oil-impregnated paper, the average value of the ratio R_{50}/R_{500} was 2·20.

This figure is confirmed by the results of a number of insulation tests on absorbent materials carried out by Mr. E. H. Rayner at the National Physical Laboratory. In Mr. Rayner's 17 tests the average value of the ratio $R_v/R_{10\,v}$ was 2·15. The figure 2·2 may, therefore, be regarded as a good average value for the ratio $R_v/R_{10\,v}$ for insulation which is wholly composed of absorbent materials, used under a moderate degree of compression.

But in the case of 12 curves obtained from compound insulation, in which dielectrics, like mica or ebonite, were used in series with an absorbent material, the same ratio had an average value of a little less than 1·4. The difference is easily accounted for. The law of moisture conduction in any given absorbent material must be the same, whether there is a dielectric insulator in series with it or not, and, assuming the dielectric has a constant resistance, the absorbent insulator alone is responsible for the curvature of the resistance line. For an example, turn to fig. 4, which is the characteristic curve obtained from a supply meter in which the absorbent insulation of the windings is in series with the ebonite that serves to insulate the working parts from the case of the instrument. As it stands, the ratio is only 1·35, but suppose we draw a new horizontal line at such a distance below the curve as will make the ratio R_{50}/R_{500}, as deduced from measurements from this line to the curve, equal to the average for absorbent materials, namely, 2·2. Then ordinates measured from the new datum up to the curve will represent the resistance of the absorbent insulation of the windings, and the distance from the new datum line down to the original base line will represent the resistance of the ebonite.*

The resistance of the ebonite alone is found to be 810 megohms, and a datum line has been drawn in fig. 4 to represent this value. In general, if the curve of a compound insulation of the kind we are considering shows a ratio as high as 2, we may be sure that the resistance of the dielectric component has fallen to something approaching zero, either because it has broken down in itself, or because it has been shunted by some kind of absorbent dirt.

A non-absorbent dielectric in series is not the only cause of a low ratio value. We have already seen in fig. 11 how the curve flattens out when there is enough absorbed water to form paths of constant resistance in parallel with those which give a typical moisture curve. But under such circumstances the resistance curve will be so very far below the average level which it occupies under more normal conditions that there is no likelihood of the low ratio that is associated with wet insulation being attributed to the presence of a non-absorbent dielectric in series with the absorbent materials.

When condensation takes place on the surface of a solid body it first makes its appearance to us in small detached drops clinging to every roughness on the surface. If we suppose the solid body to be an insulator of immeasurable resistance, the presence of detached drops of water will not make any appreciable change in that resistance, and the same holds good for the maze of internal surfaces inside a porous insulator when moisture condenses there. But, as we have seen, the absorption of a mere trace of water brings about a vast decrease in resistance. We cannot suppose the drops to coalesce in order to form a continuous leakage path, because in that case the conduction would be simply that of an electrolyte and would follow Ohm's law, leaving the moisture curve unexplained. We must therefore look for connecting links between the drops to establish a complete conducting chain. It would be natural to suppose the links to be films of some kind condensed on the surfaces of the capillary passages in the insulator, and to account for the characteristic curve the films would have to be endowed with a property analogous to that of the electric arc; with increasing electric pressure they must increase their sectional area either by reason of the leakage current they carry, or in consequence of some effect which, like endosmose, depends on the potential gradient. This hypothesis was put to the test of experiment, and has proved itself capable of accounting for the facts.

(*To be concluded.*)

* It may be the resistance of a conducting film on the surface of the ebonite, for external films have in several cases been found to follow Ohm's law. The point requires further investigation.

The paper was discussed at Birmingham on November 26th. DR. GARRARD said that he would like to ask whether the phenomena could be explained on the basis that the conduction of the moisture within the insulator was electrolytic in character. If two electrodes were placed in a vessel of water, and a gradually increasing voltage were applied, it was found at first that the current flowing was very small, but that after a critical value had been reached the current very rapidly increased—that is to say, the electric resistance rapidly decreased. This phenomenon, with a single cell, only occurred between zero and, say, two or three volts, but in a porous insulator one could regard the moisture as being split up into a large number of cells in series, so that the voltage over which the action would be shown might be several hundred volts, as in Mr. Evershed's experiments. On this basis could also be explained the fact found by Mr. Evershed, that when the insulator was very wet the conductivity followed Ohm's law, for with a very wet substance, instead of a number of electrolytic cells in series, there was only one, and variation in resistance over the first volt or two was of no effect when working with several hundreds of volts. The electrolytic action might also account for another phenomenon which he had often observed when testing the insulation resistance of apparatus, and that was that it improved if the testing voltage were applied for a long period. One outstanding feature of the paper was the impossibility of using porous insulating materials in electrical machinery. These nowadays were not used by up-to-date manufacturers. The fibrous materials such as cotton, paper, and the like, were used simply as mechanical carriers for the insulating compound. The experiments showing that even impregnated windings absorbed moisture were remarkable; they did not, however, bring out the important point that although qualitatively a certain amount of moisture might be absorbed, yet quantitatively the amount was too small to do any harm. Tobey had shown that five or six drops of water per quart of oil reduced the dielectric strength by 25 per cent. The dielectric strength was, however, not proportional to the insulation resistance; in fact, the latter was of very little use in the investigation of the electrical properties of oil. He was not able to agree with Mr. Evershed's statement that on evaporation the electrolytic ions generally remained behind.

DR. GUY BARLOW suggested another model of absorbent insulator consisting of closely packed granules of a non-absorbent and highly insulating material (*e.g.*, sand). The leakage paths in this case might be expected to represent the conditions in a porous material much more nearly than the parallel tube model used by the author. Measurements of the resistance of porous materials at temperatures low enough to freeze the condensed moisture might be of interest. In order to produce such solidification within the pores one would probably have to lower the temperature a long way below normal freezing point.

MR. E. O. TURNER said there seemed to be great difficulty in judging the relative merits of similar pieces of insulating material tested by different experimenters. Apparently the puncture test was the only one at all consistent. The author pointed out that if a test-piece was carried though a standard course of vacuum baking and varnishing, its insulation resistance after some time settled down round about a fairly steady value. He would like to ask whether the succeeding variation of resistance could be represented as at all a definite function of the wetness of the air. Were this the case the insulation resistance, dew-point, and temperature might be measured simultaneously at a fixed voltage. Correction could be made subsequently to a chosen standard of humidity. It would be of interest to know if the author could hold out any hope of forming a basis for comparison of results obtained in this way for test pieces of uniform size. Referring to fig. 1, it seemed possible that at the final part of the curve, near the breakdown point, there might be an appreciable rise of temperature in the moisture channels—if these still persisted—due to the concentration of the energy loss in a minute volume. In this case the extremely high negative temperature coefficient of water might account for the rapid drop in the curve.

MR. FORREST said the effect of temperature upon the insulation resistance of non-absorbent insulators, such as rubber and gutta-percha, was very pronounced, and with both materials a rise in temperature was immediately accompanied by a serious fall in the insulation resistance. The author did not deal with this important point in his paper, and it would be interesting to have his views on this matter. Gutta-percha cable, when submitted to an external pressure (as occurred when it was laid at the bottom of the sea), showed a marked increase in insulation resistance, whereas the samples of paper tested by the author showed an equally marked decrease with an increase of pressure. Could the author explain this difference in behaviour? The only really satisfactory method of testing the insulation to earth of an electrical machine was by means of a flash test carefully carried out at a voltage several times greater than the normal working voltage to earth. This flash test would bring to light weaknesses in the insulation to earth, which could not be discovered by any other method.

DR. KAHN thought there were two conclusions which might be drawn from the investigations Mr. Evershed had made. The first was the fact that it was absolutely useless to specify any insulation resistance unless the voltage was stated at which it should be

measured. Although this had been recognised by many engineers, the bulk of the specifications issued still omitted to state the voltage. As the instruments by which the insulation resistance was measured were usually made to give 500 volts, and as it appeared from Mr. Evershed's paper that near this particular voltage the insulation resistance was comparatively constant, he proposed that this should be adopted as a standard voltage for testing the insulation resistance. The second point which was clearly brought out by the paper (although it had, of course, been well known to most electrical engineers), was that the insulation resistance of electrical apparatus was by no means a constant figure even if taken at a given voltage. The insulation resistance of such apparatus could sometimes be increased 10 times or more by a simple drying process. As the paper clearly showed that the insulation resistance entirely depended on the amount of moisture suspended in the insulation material, and as this was something foreign to the actual apparatus, and could be altered without altering the apparatus in any other respect, it was quite clear that the insulation resistance was not an intrinsic feature of the apparatus, and it should, therefore, be entirely abolished from all specifications. The insulation properties of such apparatus could always be clearly proved by the usual pressure tests.

Mr. W. C. S. Phillips asked if the author had conducted any experiments on paraffin wax, as he considered it desirable that his theory should be tested on substances which could be melted *in vacuo*. Swann had worked at a potential gradient of 50,000 volts per cm. The method adopted by him was to enclose the paraffin wax between two metal plates surrounded by guard rings. A third plate was completely immersed in the paraffin wax, which was heated for some time to 120° C. *in vacuo*, and then allowed to cool. If the substance between the plates obeyed Ohm's law, there should be no change in potential of either of the plates. This was shown to be the case when the wax was replaced by paraffin oil. Thus, the electrometer only showed that portion of the current which did not obey Ohm's law, and in some of his experiments Swann calculated that the current so observed was about 60 times the Ohm's law current.

Mr. A. R. Everest said a paper was read before the American Institution several years ago, describing a research upon the variation in insulation resistance of fibrous materials with varying temperatures. The suggestion was made that the entrapped moisture existed at the lower temperatures largely in the form of disconnected particles, and that as the temperature was increased, these particles split up into smaller particles, increasing the number of continuous chains through the thickness of the material, and causing greater leakage, and accounting for the lower insulation resistance. Other investigations had shown that when a material of this class was subjected to a high potential stress heating was produced, and this, by lowering the insulation resistance increased the leakage losses, and caused still further heating. Disruptive breakdowns occurred if the temperature was allowed to exceed a critical value. If the material was kept cool by artificial means, higher pressures were endured without breakdown. A slot tube of fibrous material would have a higher breakdown value when tested on a solid steel mandrel than on a tinfoil-covered wooden mandrel. If a mica barrier were placed so as to interrupt the leakage losses which caused the cumulative heating, much higher potentials could be endured without breakdown. Insulations made up with Bakelite showed much less drop in insulation resistance with increase in temperature.

At the meeting of the Western Local Section of the Institution of Electrical Engineers, held at Cardiff on Monday, Mr. Faraday Proctor, chairman of the Section, presided, and Mr. Evershed's paper was read by his partner, Mr. Vignoles, in the absence of the author.

In the course of the discussion which followed, the Chairman asked whether any experiments had been tried to ascertain the results of tests carried out with alternating currents.

Prof. David Robinson (communicated) thought that attention might be called to the fact that the value of 2·15, which was given as the average deduced from Mr. Rayner's tests, corresponded very exactly to the simple law that the insulation resistance varied inversely as the cube root of the testing voltage in connection with figs. 6 and 7. It did not seem quite justifiable to term the whole of the variable part of the current "charging current." If the properties of the material did not vary with time there would be of course a charging current in addition to the leakage current at the moment of switching on, but even with a battery and a resistance of several megohms, a few seconds would suffice to reduce this to a negligible amount. The author's explanation of the action of his model was beautifully simple but almost too good to be true. The action of potential gradient on the positively charged water would be to exert a force on the whole length of the film, and it was not evident whether that should produce any effects, such as those indicated in fig. 18.

Mr. Sydney F. Walker (communicated) said he was in hearty agreement with the author of the paper in condemning what he termed "the blind tests of breakdown voltage."

Mr. W. A. Chamen said it was difficult to know how to discuss this most valuable and interesting paper. One naturally thought of the effect of moisture in such ticklish machines as their alternators. He supposed the idea that they had all held hitherto was that porous insulators were perfectly safe for them. He supposed they were quite right in assuming that while the temperature of the porous insulator was kept well up, say, up to 200°, they had nothing to fear from the absorption of moisture in such a way as to reduce their insulation within dangerous limits.

Mr. J. Lang Wilson and others also briefly discussed the paper, and the consensus of opinion was that the subject was an extremely difficult one, and required very great study before members could venture to criticise the conclusions the author of the paper had come to.

NOTES ON INCANDESCENT LAMP MANUFACTURE.

In the course of an article in the *Elektrot. Anzeiger*, H. T. Erb comments upon the very small margin of profit which can accrue to manufacturers of metal-filament lamps in view of the low level to which retail prices have now been reduced. The manufacture of low-voltage lamps is still much simpler than the manufacture of high-voltage types, and in view of the increasing demand for 14-volt (or other low-pressure) metal lamps for advertising and decorating work, it would probably pay some firms to specialise on low-voltage lamp manufacture. The problem of grading lamps for series running has been solved well enough to permit of sign and other low-voltage lamps being run in series, but there is yet room for further improvement in this direction. The figures below summarise the manufacturing cost per thousand 220-volt 25-watt lamps, as given by the author. These data are said to be drawn from actual works records, and their arrangement shows how the value of the lamp increases as its manufacture proceeds; at what stage of its manufacture the greatest outlay in material and wages is required; the percentage of breakages in each stage, and the value of the pieces broken.

Item.	Brought forward.* Shgs.	Materials. Shgs.	Wages. Shgs.	Breakages. Per cent.	Breakages. Value. Shgs.
Bulb	—	37·1	4·5	1·5	0·63
Crown	—	4·9	1·52	5·0	0·32
Electrodes ...	—	28·0	2·25	1·0	0·29
Stem	—	41·3	7·2	1·0	0·49
Star	48·5	26 3	13·15	—	—
Attachment ...	88·0	133·0	32·10	2·0	5·04
Melting on ...	253·0	37·1	9 7	5·3	15·85
Pumping	300·0	—	11·8	6·0	18·70
Flashing	312·0	0·6	1·96	1·5	4·70
Adjustment and completion	314·0	21·8	9·35	2·0	6·90
	345·0	261·0	85·0	—	53·0

* Cross total cols. 2, 3 and 4 of previous line.

Up to a certain stage in manufacture, pieces are prepared which may subsequently be used in any one of a number of types of lamp, but beyond this stage parts are selected and assembled and the true lamp manufacture commences. In the above table, no allowance is made for the cost of gas, current, standing charges and unproductive labour; in practice, these items should be reduced to a minimum. The figures in column 2 of the table show the value per thousand lamps of the materials in and wages spent on the lamps at various stages of their manufacture. As manufacture proceeds, the value of the piece handled during any particular operation increases rapidly since it becomes a complex structure, damage to which involves a greater wastage of time and material than is accounted for by the member actually broken. The total cost per thousand lamps for wages (productive labour) and materials appears to be 345 shillings, and the value of the pieces broken is 53 shillings.

Electrical Driving in Cotton Mills.—Mr. J. W. Crowley, textile expert of Messrs. Siemens Bros., Ltd., gave a lecture on the electrical driving of looms, ring-spinning and doubling frames, at Haslingden Technical School, on Nov. 19th, the lecture having been arranged by the Cotton Sub-Committee of the Education Committee. Mr. Crowley did not recommend individual driving in every case. He said that in the Little Harwood Shed, Blackburn, there were 1,140 looms, each driven by its own motor. So far as ring-spinning and doubling frames were concerned, he thought there was now no question of the advantages of individual driving over group driving, but in respect of other machinery in many cases the question was still an open one. It was of the utmost importance to the textile manufacturer about to introduce electrical driving that he should have expert advice as to what system to adopt.

THE STAFF ENGINEERS' ASSOCIATION.

THIS, the latest Engineering Association, is being established mainly for economic purposes, by professional engineers, for their mutual protection and support. It embraces civil, electrical and mechanical engineers, and is intended to work on lines similar to those adopted by the Law Society and the British Medical Association, with a view to furthering the interests of its members, promoting a higher public sense of the rank of the engineering profession, and elevating the status of engineers. It is proposed to attain these objects by the following means :—

(*a*) By the study of economic and social questions, and by the development of the spirit of unity ; (*b*) through the medium of statistical information and extensive inquiries into existing conditions of employment, with a view to their regulation if desirable ; (*c*) by the systematic airing of grievances in the Press ; (*d*) by means of monetary assistance to members ; (*e*) by the aid of vacancy lists and an information bureau ; (*f*) by means of free advice in law cases of professional interest, with partial or total assistance in defence ; (*g*) by free advice in connection with patents ; (*h*) by means of local branches of the Association ; (*i*) by provision for intercourse amongst members, and by the acquisition and dissemination of special information of mutual interest and assistance ; (*j*) by influencing the framing of laws, in so far as they concern members of the Association ; and (*k*) by all other methods conducive to the attainment of the objects of the Association.

The members of the Association (other than honorary members) will consist of two classes, viz., Members and Associates. Each applicant for election as member must be at least 24 years of age, and must produce evidence that he has been regularly trained as an engineer, or that he has attained to a position of eminence in the profession. Each applicant for election as Associate Member must be at least 18 years of age, and must produce evidence that he is undergoing an engineering training. The subscription will range from 10s. to 30s. per annum.

The general assistance to members will comprise free advice concerning all patent questions, legal advice and protection in disputes regarding conditions of employment and remuneration, &c. Information will be supplied to members regarding vacant posts, firms and working conditions at home and abroad, as well as technical and practical information of use to members in their various occupations.

Members may receive assistance in case 'of unemployment, or if they lose their employment by promoting the objects of the Association, and each member may apply for special monetary assistance in case of necessity. Names of members will only be disclosed with the consent of a general meeting.

The inception of the S.E.A. was first suggested by a small body of engineers attached to the staffs of one or two representative firms ; the enthusiasm of this small band of reformers—each member of which holds a good appointment—has spread to such an extent that their tentative proposals, we are told, are being supported with a zeal which equals their best expectations.

In the early days it was alleged that a combination of employers had been formed with objects adverse to the interests of their employés, and if this charge could be substantiated, the necessity for a protective association would be obvious. There is nothing undesirable about the formation of the Association as long as it adheres to its legitimate objects, and is conducted by honourable men. The organisation of the S.E.A. will be protective, and not aggressive. Technical lectures or papers will form merely an adjunct of its general work ; it is solely because other engineering associations are so purely technical that the S.E.A.—the business association—has been designed.

The contention in support of the S.E.A. is that when a large body of co-workers pull together, their general agreement and insistence will go far to remove adverse conditions of working and contract, which obviously means that economically the sphere of engineering employment will be improved.

That the staff engineer is largely responsible for our remarkable technical and scientific development—which is changing completely the conditions of every country—does not seem to be appreciated by the public in any way. For this reason alone, therefore, it is patent that engineers are justified in combining for better status and conditions, since, in common with the world's chief workers, they deserve both.

The main object of the S.E.A. will be to do for engineers what the B.M.A. has done for the doctors and the Law Society for the lawyers. Both these institutions protect only the economic interests of their respective members, and they have not only raised and ensured the status of the professions they protect, but they have even influenced potently the framing of Parliamentary and ocal laws.

The address of the hon. secretary of the Staff Engineers' Association is 31, Queen Victoria Street, London, E.C.

New Radium Supply.—By a new process, which has just been discovered by Prof. Rudolf Sommer, of Germany, it is possible to extract pure radium salts from carnotite ore, both quickly and economically.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,298. "Electric arc lamps." A. T. DOWDELL. November 17th.

26,309. "Spring motor and magneto attachment." A. H. THOMAS. November 17th.

26,338. "Interrupter for electro-magnetic ignition devices." E. ROGALSKI. November 17th. (Complete.)

26,340. "Hydraulic or electro-hydraulic presses." MASCHINENFABRIK OERLIKON. November 17th. (Convention date, December 19th, 1912, Switzerland.) (Complete.)

26,351. "Electrically-lighted bedstead lamp bracket." A. G. BILCLIFFE November 17th.

26,361. "Adjustable electrical resistances." W. ENGELKE and H. BLOODWORTH. November 17th.

26,364. "Magnetic circuits." A. F. JOBKE. November 17th. (Complete.)

26,367. "Holders for electrodes of electric arcs." H. AYRTON. November 17th.

26,374. "Ignition systems for internal combustion engines." W. R. PRESLAND and A. SARGENT. November 17th.

26,388. "Electrically-actuated musical key-instruments." R. POETZELBERGER. November 17th. (Convention date, November 18th, 1912, Germany.) (Complete.)

26,398. "Electric telegraphy." H. W. MALCOLM. November 18th.

26,400. "Compass corrector." E. A. SUTER. November 18th.

26,402. "Radio-telephony." W. T. DITCHAM. November 18th.

26,415. "Alternating current dynamo-electric machines." L. J. HUNT and SANDYCROFT, LTD. November 18th.

26,419. "High-duty electric lamps." C. V. BOYS. November 18th.

26,426. "Ignition devices for internal-combustion engines." B. J. SHORTER. November 18th.

26,462. "Electric hot-plates and other heating-appliances." W. A. S. BENSON & Co., LTD., and W. J. SIMS. November 18th. (Complete.)

26,469. "Electrical fuse lighting devices." J. F. WILLIAMS. November 18th.

26,479. "Telegraph or like systems and apparatus therefor." H. H. HARRISON and AUTOMATIC TELEPHONE MANUFACTURING Co., LTD. November 18th. (Complete.)

26,494. "Supply of electricity for heating, lighting, and other purposes." A. F. BERRY. November 18th.

26,495. "Supply of electricity." A. F. BERRY. November 18th.

26,496. "Supply of electric current or gas and meters therefor." A. F. BERRY. November 18th.

26,497. "Electrically and gas heated cooking-ovens. A. F. BERRY. November 18th.

26,502 "Dynamo-electrical means for starting internal-combustion engines and lighting systems in connection therewith." L. J. WOLF. November 18th. (Complete.)

26,511. "Electric heating elements used in connection with electric heating-apparatus." G. H. CLARKSON. November 19th.

26,525. "Insulating cover for domestic utensils." W. A. S. BENSON & Co., LTD., and C. J. SCOTT. November 19th.

26,546. "Electrical resistances, particularly applicable to electric heating elements adapted to be immersed in liquids." F. B. COX. November 19th.

26,570. "Telegraphic transmitters." G. VISCA. November 19th. (Complete.)

26,575. "Electro-magnetic switches." A. H. CURTIS, F. N. PICKETT, V. M. COLTON, and IGRANIC ELECTRIC Co., LTD. November 19th.

26,582. "Electrical welding-machines." WESTERN ELECTRIC Co., LTD. November 19th. (F. T. Woodward, Belgium.) (Complete.)

26,592. "Electric hand-lamps." A. SCHRADER. November 19th. (Complete.)

26,600. "Devices for attaching electric telegraphic and telephonic cables or wires to insulators." H. PARRA. November 20th. (Convention date, November 25th, 1912, France.) (Complete.)

26,602. "Method of and means for use in connecting an automatic telephone sub-section system to an automatic central station." H. C. STEIDLE. November 19th. (Complete.)

26,608. "Selective signalling-devices." WESTERN ELECTRIC Co., LTD. November 19th. (F. T. Woodward, Belgium.) (Complete.)

26,609. "Electric welding-machines." WESTERN ELECTRIC Co., LTD. November 19th. (F. T. Woodward, Belgium.) (Complete.)

26,623. "Voltage regulators for electric generators." A. H. OLMSTED. November 19th.

26,631. "Electric clocks." H. ARON ELEKTRICITATSZAHLERFABRIK G.m.b.H. November 19th. (Convention date, February 26th, 1913, Germany.) (Complete.)

26,635. "Electric switches." A. BONNELLA and G. J. BONNELLA. November 19th.

26,646. "Voltage and output regulators for dynamo-electric machines." T. FERGUSON and J. R. JOHNSTONE. November 20th.

26,657. "Shade-holder for incandescent electric lamps. T. MCCLELLAND, Junior. November 20th.

26,684. "Insulated electric conductors." WESTERN ELECTRIC Co., LTD. November 20th. (F. T. Woodward, Belgium.) (Complete.)

26,687. "Electro-magnetic relays." O. D. LUCAS. November 20th.

26,688. "Electrically-controlled starters for internal-combustion engines." O. D. LUCAS. November 20th.

26,695. "X-ray apparatus." E. R. MORTON and NEWTON & WRIGHT, LTD. November 20th.

26,700. "Electro-pneumatic continuous brake for vehicles." F. V. LE MANQUAIS and J. W. SIMS. November 20th.

26,702. "Excess voltage safety devices for high-tension circuits." D. SAMALA. November 20th.

26,704. "Means for supporting resistance wires and the like." CREDENDA CONDUITS Co., LTD., and V. SUMMERHAYES. November 20th.

26,708. "Water-tight, telephonic, telegraphic, and the like electrical apparatus." E. A. GRAHAM. November 20th. (Complete.)

26,713. "Metal filament lamps." B. GNANN. November 20th. (Convention date, September 1st, 1913, Germany.) (Complete.)

26,733. "Electric controlling mechanism for marine and like engines." S. RUMOLINO. November 20th. (Addition to 29,754/09.) (Complete.)

26,763. "Arms for telegraph poles and telephone poles." A. L. BAYLEY. November 21st.

26,764. "Fittings for electrical conduits and method of manufacturing same." J. R. A. HEMMING. November 21st.

26,802. "Electrostatic separators for treating inflammable or explosive materials." J. KRAUS. November 21st. (Convention date, October 27th, 1913, Germany.) (Complete.)

26,817. "Dynamo-electric machinery, more particularly dynamo-electric machinery used for starting and lighting purposes." C. A. VANDERVELL and A. H. MIDGLEY. November 21st.

26,827. "High-frequency electric-current generator." E. C. HOEGERSTAEDT and H. S. WESCOTT. November 21st.

26,831. Means for use in controlling the temperature of electrically-heated cooking and sterilizing apparatus and the like." C. E. HEARSON. November 21st.

26,834. "Multiple arrangements of high-frequency electric-current generators." P. O. PEDERSEN and V. POULSEN. November 21st. (Convention date, December 12th, 1912, Denmark.) (Complete.)

26,835. "Electrically-heated cooking and sterilizing apparatus." C. E. HEARSON. November 21st.

26,855. "Electrically-controlled railway block-signalling and apparatus therefor." P. BROWNE. November 22nd. (Complete.)

26,899. "Electrolytic measuring-instruments." H. S. HATFIELD and CHAMBERLAIN & HOOKHAM, Ltd. November 22nd. (Complete.)

26,905. "Circuit arrangements for telephone or other systems." SIEMENS BROS. & Co., LTD., E. A. LAIDLAW, and W. H. GRINSTED. November 22nd. (Complete.)

26,906. "Automatic regulating-devices for dynamo or other electric machines." R. BOSCH (Firm of.) November 22nd. (Convention date, November 1st, 1913, Germany.) (Complete.)

26,913. "Arc lamps." A. W. PENROSE & Co., LTD., and M. OWEN. November 22nd.

26,929. "Method and means for comparing electrical quantities." C. G. E. MILNE, H. T. GEORGE, P. M. LEVY, and J. TUCKER. November 22nd.

26,934. "Transformation of the frequency of high-frequency alternating-currents for wireless telegraphy and telephony." SOC. MARIUS LATOUR ET CIE. November 22nd. (Convention date, November 22nd, 1912, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

ELECTRIC HEATING APPARATUS. G. Wilkinson. 19,543. August 27th. (February 18th, 1913.)

WATERPROOF COVERING OF ELECTRIC CABLES. C. J. Beaver and E. A. Claremont. 22,355. October 1st.

CIRCLES FOR MAGNETIC COMPASSES, SURVEYING, AND LEVELLING INSTRUMENTS. J. C. Fergusson. 22,568. October 4th.

FITTINGS FOR ELECTRIC LIGHTING PURPOSES. F. A. Wilkinson. 24,953. October 31st.

ADVERTISING LAMPS. B. Ahner. 25,153. November 2nd.

MAGNETIC SEPARATORS. J. T. Pollard and R. Emmott. 25,195. November 4th.

AUTOMATIC REGULATING DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co. and C. McCarthy-Jones. 25,286. November 4th.

REFRACTORY AND HEAT-INSULATING MATERIAL. British Thomson-Houston Co. (General Electric Co.). 25,370. November 5th.

PRINTING TELEGRAPH SYSTEMS. Western Electric Co. (Western Electric Co.). 25,382. November 5th.

TELEPHONE INSTRUMENT SET ADAPTED FOR TWO LINES. Siemens Bros. & Co., and E. A. Laidlaw. 25,673. November 8th.

STRIKING MECHANISM FOR ELECTRIC CLOCKS. L. Asprey and E. Farrow. 26,194. November 14th.

ELECTRICITY METERS OF THE MERCURY-MOTOR TYPE. W. Hamilton & Ferranti, Ltd. 26,359. November 16th.

PROCESS AND MEANS FOR THE PRODUCTION OF ELECTROTYPES FOR LETTERPRESS PRINTING. I. T. Nelson and J. Murray. 27,911. December 4th.

CONSTRUCTION OF ELECTRIC IRONS. H. Hirst and G. Maurice. 29,350. December 20th.

ELECTRICITY MULTICORE CABLE DIVIDING BOXES OR APPARATUS. British Insulated and Helsby Cables, Ltd., and R. W. Blades. 29,783. December 27th.

1913.

MANUFACTURE OF ELECTRIC INCANDESCENT LAMPS. Naamlooze Vennootschap Philips' Metal Gloeilampenfabriek. 1,340. January 16th. (December 6th, 1912.)

PRODUCTION OF HYDROGEN AND OXYGEN BY ELECTROLYTIC PROCESSES. Knowles Oxygen Co., and R. W. Grant. 1,812. January 22nd.

ELECTRIC QUICK-MAKE AND QUICK-BREAK VIBRATION PROOF SWITCH-FUSES. R. C. Perfect. 1,984. January 24th.

MEANS FOR EFFECTING IGNITION IN INTERNAL-COMBUSTION ENGINES. G. E. Heyl and T. T. Baker. 3,057. February 5th. (July 29th, 1912.)

IGNITION APPARATUS OF GAS-ENGINES. C. S. Sydenham. 4,965. February 27th.

CONDUCTORS FOR ELECTRICAL MACHINES. Akt. Ges. Brown, Boveri et Cie. 6,036. March 11th. (March 18th, 1912.)

SOCKETS AND TERMINALS FOR ELECTRIC LEADS. A. G. Bloxham. (Robert Bosch, Firm of.) 6,551. March 17th.

TRANSMITTING APPARATUS FOR ELECTRIC SELECTING SYSTEMS. Western Electric Co. (Western Electric Co.). 6,767. March 19th. (Divided Application on 25,382/12. November 5th.)

PAPER FEED-MECHANISMS FOR PRINTING TELEGRAPH AND SIMILAR APPARATUS. Western Electric Co. (Western Electric Co.). 6,768. March 19th. (Divided Application on 25,382/12. November 5th.)

ELECTRIC SIGNALLING. J. C. Thomson. 9,632. April 24th.

ALARM DEVICE FOR MONEY SAFES. P. Pelli. 10,087. April 29th. (September 3rd, 1912).

APPARATUS FOR HEATING WATER AND OTHER LIQUIDS BY ELECTRICITY, PARTICULARLY APPLICABLE AS A BATH HEATER. C. Arpin. 10,403. May 2nd. (May 3rd, 1912.)

MEANS FOR REGULATING MACHINES FOR MULTIPLE WIRE DRAWING OR FOR CONTINUOUS ROLLING. Soc. Anon des Forges et Acieries de Huta Bankowa, 10,901. May 8th. (May 11th, 1912.)

MEANS FOR OPERATING DIRECTION SWITCHES AND RESISTANCE IN ELECTRIC MOTOR-DRIVEN CONTROLLERS. Electromotor Equipment Co., and A. J. Barlow. 11,069. May 10th.

ELECTRIC TELEGRAPH STATIONS. M. C. Dos Santos. 11,243. May 14th. (May 14th, 1912.)

SUSPENSION OF OVERHEAD LINE WIRES FOR ELECTRIC TRACTION. Soc. Vedovelli, Priestley et Cie. 11,310. May 14th. (November 26th, 1912.)

ELECTRIC FURNACES. Compagnie pour le Traitement des Metaux et des Minerais par Electricite. 12,444. May 28th. (Jan 10th, 1913.)

ELECTRICAL MINE-IGNITING MACHINES. Elektrotechnische Fabrik Schaffler & Co. 12,813. June 2nd. (February 5th, 1913.)

METHOD OF CONSTRUCTION OF ELECTRICAL HEATING RESISTANCES PARTICULARLY APPLICABLE TO ELECTRICAL FURNACES. Soc. Generale des Nitrures. 12,837. June 2nd. (July 26th, 1912.)

SYSTEMS EMPLOYING ELECTRIC MOTORS CONTROLLED SYNCHRONOUSLY FROM A DISTANCE. J. L. Routin. 13,084. June 5th. (Divided Application on 735/13, January 9th.)

TIMING DEVICES FOR ELECTRIC IGNITION IN INTERNAL COMBUSTION ENGINES. W. C. Kitchell. 13,241. June 7th.

ALTERNATING CURRENT ELECTRO-MAGNETS. Otis Elevator Co.. (Otis Elevator Ges. 13315. June 9th.

DYNAMO-ELECTRIC MACHINES. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 13,435. June 10th.

VAPOUR ELECTRIC APPARATUS. M. Von Recklinghausen, A. Helbronner, and V. Henri. 13,490. June 11th. (June 11th, 1913.)

APPARATUS FOR CAUSING ELECTRICAL IMPULSES FOR TRANSMISSION TO A DISTANCE. J. A. Gardner and A. Ferguson. 13793. June 14th. (Addition to 27223/10.)

ELECTRIC INCANDESCENT LAMPS. H. Cheron, H. Dominici and R. Biquard. 13822. June 14th. (June 15th, 1912.)

COMBINED SWITCHING AND PLUG CONTACTS. J. P. Jakobsen and H. F. Jensen. 14,330. June 20th. (June 21st, 1912.)

ELECTROSTATIC APPARATUS FOR SEPARATING AND CLEANING GRITS, GRAIN OR THE LIKE. J. Kraus. 14587. June 24th. (May 9th, 1913.)

MINE-IGNITING MACHINE. Cahücitwerke Nürenberg. 14,870. June 27th. (July 1st, 1912.)

PUSH-BUTTON SWITCHES FOR ELECTRIC HORNS USED ON MOTOR-CARS AND THE LIKE. A. Goodwin and C. A. Vandervell. 14,942. June 28th.

CHANGE-OVER ARRANGEMENTS FOR ELECTRIC SUPPLY OR CONTROL SYSTEMS. Siemens Bros. Dynamo Works, F. Lydall and C. E. Fairburn. 15,149. July 1st.

DYNAMO-ELECTRIC MACHINES. Brolt Ltd., Brooks and W. Holt. 15,585. July 7th.

ELECTRICAL DEVICES FOR OPERATING DOOR SASHES OF AUTOMOBILES AND OTHER CARRIAGES. J. F. P. de la Riboisiere. 15,648. July 7th. (July 9th, 1912.)

WIRELESS TELEGRAPH RECEIVERS. J. G. Balsillie. 15,674. July 7th. September 23rd, 1912.)

SAFETY DEVICES FOR ELECTRIC CONDUCTORS. G. Giles. 15,951. July 10th. (July 20th, 1912. Addition to 4,997/09.)

ELECTROLYTIC DIAPHRAGMS. H. A. Wagner. 16048. July 11th.

DEVICE FOR TRANSFERRING PRESSURE FROM RIGID BODIES TO ELECTRIC INSULATORS. M. Hedlund. 16,262. July 15th.

COOLING OF DYNAMO-ELECTRIC MACHINES. Allgemeine Elektricitats Ges. 16,391. July 15th. (July 16th, 1912.)

DYNAMO-ELECTRIC MACHINERY. Siemens Bros. Dynamo Works, Ltd., and G. H. Taylor. 16,526. July 18th.

COMMUTATORS FOR ELECTRIC METERS. H. Aron Elektricitatszahlerfabrik Ges. 16,753. July 21st. (March 10th, 1913.)

ELECTRIC RELAY. Siemens & Halske Akt. Ges. 17,879. August 5th. (November 18th, 1912. Addition to 17,137/13.)

MEANS FOR REGULATING THE EFFICIENCY OF ELECTRIC CURRENT GENERATORS WORKING AT VARIABLE SPEED. F. Eichert. 17922. August 6th. (April 4th, 1913.)

ELECTRO-MAGNETIC DEVICE FOR ADJUSTING VALVES FROM A DISTANCE. B. Bruns. 18,526. August 14th. (August 14th, 1912.)

SPARKING PLUGS. Soc. Générale des Huiles et Fournitures Industrielles l'Oleo. 18753. August 18th. (June 6th, 1913.)

ELECTRIC INSULATORS. A. Orinschnig. 18755. August 18th. (May 5th, 1913.)

RE-INKING MECHANISM FOR USE IN PRINTING TELEGRAPHS. Western Electric Co. (Western Electric Co.). 19,124. August 22nd. (Divided Application on 25,382/12. November 5th.)

TELEPHONE EXCHANGE SYSTEMS. F. R. McBerty. 19,421. August 27th. (November 3rd, 1911. Divided Application on 25,174/12. November 2nd.)

ELECTRIC RAT-TRAPS. B. F. Ash. 19,496. August 28th. (August 28th, 1912.)

PEDAL-DRIVEN ELECTRIC GENERATORS FOR USE IN CONNECTION WITH PROJECTING APPARATUS AND THE LIKE. Soc. Internationale de Lumiere Froide. (Procedes Dussaud.) 20,288. September 8th. (September 7th, 1912.)

SWITCHES FOR OPENING AND CLOSING ELECTRIC CIRCUITS. H. Leitner. 21,751. September 26th (Addition to 2,747/12.)

METAL-WORKING MACHINES WITH WORK-HOLDING MAGNETS. Magnet Werk Ges. Eisenach Spezialfabrik für Elektromagnet-Apparate. 22,706. October 8th. (October 25th, 1912.)

School Lighting.—In the course of a paper recently read by Mr. Daniel H. Ogley, M.Eng., of the Royal Technical Institute, Salford, the author points out that school lighting, since it is in their school days that children are in the most easily influenced stage of their development, needs special attention. The medical man examines the eyesight of a child, finds that it is defective, gives an order for certain kinds of glasses, and proceeds with the examination of the next child. The cause is hardly ever inquired into, though in many cases it would be found that incorrect illumination of the premises was in great part to blame. He quotes Dr. Kerr, Medical Officer to the L.C.C., as saying in a recent report that a child requires a better light to read by than does an adult, to whom reading is second nature, and disagrees with Dr. Kerr's statement that the least illumination permissible on the school desk of a child has been found to equal 1 ft.-candle. A minimum of 2 ft.-candles for reading and writing is, in his opinion, required, while for drawing and distinguishing fine detail, from 2 to 5 ft.-candles are necessary, according to conditions. It cannot be too strongly emphasised that exposed light sources of great intrinsic brilliancy constitute a severe source of eye trouble when placed directly in the field of view, and should be avoided under all circumstances. If the direct illumination system is in use, the best plan is to insist on adequate shading, and if the lamps are not entirely surrounded by the shades, the lower part should be frosted to avoid even a momentary direct view of the filament. The inverted system has much to recommend it, but the absence of shadows is rather wearisome, and objects appear flat, tiring the eye in the effort to perceive them correctly. The inverted system, with a certain amount of direct lighting to produce shadows, is perhaps better. Reflection should be avoided from desks and matter placed thereon. Too much stress cannot be laid upon the steadiness of the light supply. Flickering gas jets are sources of much trouble, and metal-filament lamps, owing to the low specific heat of the metal, respond much more readily to changes in pressure than do carbon ones. Direct measurement of illumination should be insisted upon, remembering that for most purposes an illumination of 2 ft.-candles is sufficient.